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PRACTICAL
HEALTH LESSONS

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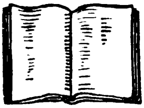
Growing Healthy and Strong in a City Playground.

PRACTICAL HEALTH LESSONS

PART I

BY
EUGENE A. HEILMAN, M. D.
PRINCIPAL HESTON PUBLIC SCHOOL, PHILADELPHIA



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PREFACE

In no field of human activity has greater progress been made during recent years than in hygiene and sanitation. While the advance must always be led by a small but zealous group of workers, an accurate and up-to-date knowledge of the elementary facts of these two subjects should be the common property of all the people. It is the purpose of "Practical Health Lessons" to present to pupils in the grammar grades of the elementary schools, in clear and simple language, all the essential facts of personal hygiene and as much of public hygiene as every citizen ought to know.

Health instruction is effective only as it leads the pupil to live in accordance with the laws of health. The average grammar grade pupil will pay little heed to laws for which he sees no reason. The reasons for these laws are found partly in the structure of the body, but chiefly in the way the body works and in the nature of the external dangers to which it is exposed. To care for one's health intelligently, some knowledge of anatomy and physiology is absolutely necessary. So much—and no more—these books aim to give. What is especially emphasized throughout is *the right way to live*, but the *reason* for this way is always made clear. The subject of disease germs and the prevention of communicable diseases is treated fully and is presented in such a way that it will be easily comprehended by pupils of the lowest grammar grades.

For the purpose of arousing and stimulating his interest in the subject and of making the teaching more effective, an effort has been made, wherever it seemed possible, to draw on the pupil's own observation and experience in developing the reasons for the health laws which he must learn. While these laws are stated as positively and emphatically as possible, special pains have been taken to avoid dogmatic and unqualified statements which may be contradicted by the pupil's own experience.

There is an unfortunate tendency to make health instruction merely a matter for supplementary reading. Both the teacher and the pupil should realize that hygiene is a subject of vital importance, and that the preservation of one's health is a matter that deserves the most careful and earnest study. These "Health Lessons" are not intended for casual reading. They are to be *studied*, and it is confidently believed that they contain nothing that is not worth serious study.

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HEALTH LESSONS

PART I

CHAPTER I

WHY WE STUDY HYGIENE

1. The Best Study.—There are many things that boys and girls must learn at school,—reading, writing, arithmetic, spelling, and so on,—but there is one study that is worth more than any of the others.

There is nothing else in the whole world that is worth so much to all of us as *good health.* Many rich men would give all the money they have if they could only be well. We may have many good things, but without good health we can not enjoy any of them fully. Think of the pleasures that we miss when we are sick and have to stay in bed. No one can be entirely happy if he is not well.

All boys and girls like to be promoted at the end of the term. Most of them try to make good records in their studies. When they become old enough to leave school, they wish to make good records in their work. They wish to be *successful men and women.* The boy who is sick falls behind his class in his lessons. The man who is not well can not do his best work. It is much harder for him to be successful in his business than if he were strong and healthy.

There is nothing else that has so much to do with our happiness, our usefulness, and our success as good health. Good health is the best thing in the world, and the best thing we can learn at school is *how to keep well.* The best study of all is *hygiene. Hygiene is knowing how to keep well.* It teaches us how to take care of our bodies, so that we may be strong and healthy.

2. Sickness Can Be Prevented.—People used to think that they could not help getting sick,—that sickness was one of the things that could not be prevented, like storms and earthquakes. We have learned that this is not so, that sickness is not necessary, and that most kinds of sickness can be prevented. Nearly always, when people get sick, it is because they do not take proper care of their bodies. Sometimes people get sick because they do not know how to take care of their bodies, but very often they are just careless. They know what they ought to do, but it is too much trouble. Sometimes we get sick because of some other person's carelessness.

Most kinds of sickness can be prevented. The things which make us sick are not hard to understand. Even a child can learn what they are and how they can be avoided. *It is much easier to keep well than to get well.* Most of us can keep well if we care enough about it.

3. What Hygiene Does for Us.—Nearly every city and state keeps careful records showing how many people are sick, how many die each year, and at what age they die. Some of these records will help us to understand what the study of hygiene is doing for us.

A hundred years ago, out of every thousand people living in this country, thirty-six died every year. Since that time we have learned a great deal about keeping well. At present, only sixteen or seventeen people out of each thousand die every year. There are about 100,000,000 people in our country. About 1,600,000 die every year. If we knew no more about hygiene than people did a hundred years ago, there would be 3,600,000 deaths annually. In our country alone the study of hygiene is saving the lives of 2,000,000 people each year.

A hundred years ago most people did not live to be more than thirty years old. Some, of course, lived much longer. A few lived to a great age, but most people died before they were thirty. At the present time most people live to be nearly fifty years old. The study of hygiene helps many of us to live almost twenty years longer than most people lived a hundred years ago.

4. Why We Should Study Hygiene.—If we wish to be happy, to be successful, to live long and well, we must learn how to take care of our bodies. We must learn what things will make us sick and how these things can be avoided. We should study hygiene because it teaches us how to keep well,—how to make our lives longer, happier, and more useful.

It is not enough to *know how* to keep well. Knowing how will not help us unless we are willing to *do* the things that are necessary to keep well. Very often it will seem a great deal of trouble to do these things, but we can not expect to have good health and to live long and happily unless we are willing to go to some trouble for the sake of keeping well.

5. Anatomy, Physiology, and Hygiene.—To learn how to keep well we must know something about the different parts of the body and how they are put together. We must learn a little about the bones, the muscles, the stomach, and so on. This study is called *anatomy.* Then we must know something about the *use* of each of these parts. We must know how they work. This is called *physiology.* What we need most of all is to learn *how to take care* of each part of the body. This is called *hygiene.*

QUESTIONS

What is hygiene? Tell in your own words why it is an important study. Do you think any other study is more important? Give your reasons.

Why do people get sick? Give several reasons. Have you been sick this year? What do you think caused your sickness? Do you think it could have been prevented?

Explain two ways in which the study of hygiene has helped the people of our country.

Give some good reasons for studying hygiene. Do you care about any of these things? Which do you care for most?

What things do we learn about when we study anatomy? Physiology? Hygiene?

CHAPTER II

THE BONES

6. The Skeleton and Its Purpose.—When a carpenter builds a wooden house, he first puts up a *framework* of heavy timbers. All the other parts of the house are supported by this framework. Large buildings in the city often have a framework of iron or steel (Fig. 1).

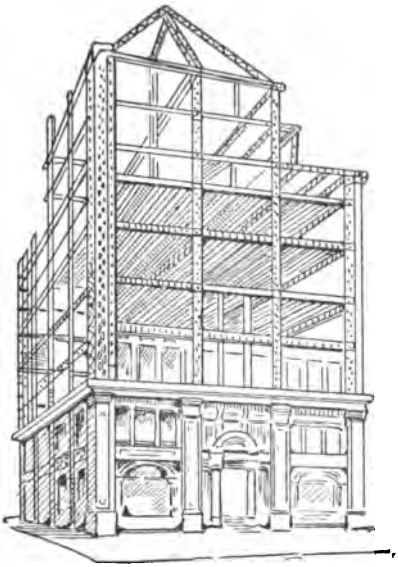

Fig. 1.—The framework of a building.

Our bodies have a framework which is very much like the framework of a building. The framework of the body is called the *skeleton*. It is made up of *bones*. There are more than 200 bones in the skeleton. The skeleton is the bony framework which gives shape to the body and supports all of its parts (Fig. 2).

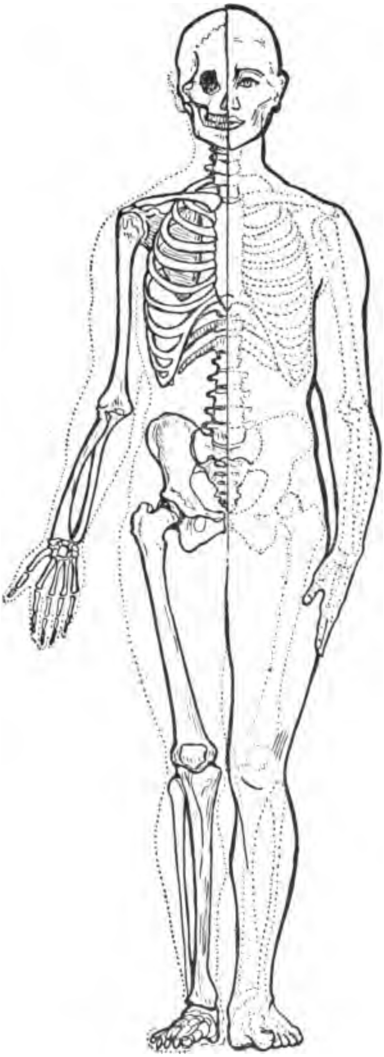

Fig. 2.—The skeleton.

7. Parts of the Skeleton.—The body has a number of different parts, and each part has its own name. The main part of the body is called the *trunk*. Above the trunk is the *head*. The arms are called the *upper limbs* and the legs the *lower limbs*.

The bones of the head form the *skull*. The upper part of the skull is a strong, bony case which holds and protects the brain.

The bones of the trunk are the backbone, the ribs, the breast-bone, the collar bones, the shoulder blades, and the hip bones.

The backbone is not one bone, but is made up of twenty-six small bones, fastened together like a string of spools. It is often called the *spinal column* or the *spine*. The backbone holds the body erect. Each of the bones of the spinal column has a hole in it, like a spool. These holes form a long tube or canal, called the *spinal canal*, which contains the *spinal cord*, one of the principal parts of the nervous system.

There are twenty-four ribs, twelve on each side. All of them are fastened to the backbone. The ribs form the sides of the chest. They protect the heart and the lungs from injury.

The shoulder blades are broad, flat bones, one behind each shoulder. The collar bones are long slender bones that stretch from the top of the breast-bone to the shoulder blades. They brace the shoulders back. The hip bones are two heavy, flat bones which carry the whole weight of the trunk.

8. The Cavities of the Trunk.—The trunk is divided into two parts. The upper part is called the *chest*. It holds the heart and the lungs. The lower part of the trunk is called the *abdomen*. The stomach, the intestines, the liver, and other important parts of the body are in the abdomen (Fig. 3).

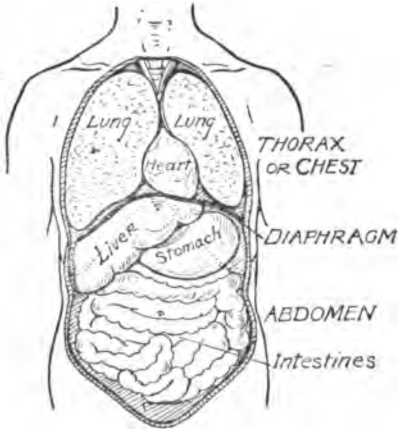

Fig. 3.—Cavities of the trunk, and the principal organs in each.

9. The Joints.—The place where two bones are fastened together is called a *joint*. The purpose of the joints is to hold the bones of the skeleton together and at the same time allow them to move.

There are two common kinds of joints, *hinge joints* and *ball-and-socket joints*. The elbow joint and the knee joint are hinge joints. Here the bones move back and forth like the hinges of a door. At the shoulder we can move the arm in all directions. The bone of the arm has a round ball on the end of it which fits into a cup or socket in the shoulder blade. The shoulder joint and the hip joint are ball-and-socket joints.

The bones are held together at the joints by tough bands called *ligaments*.

10. Uses of the Bones.—Bones have three great uses. They give shape to the body. They protect the delicate parts of the body from injury. They help to produce the different movements of the body.

11. Of What Bones are Made.—Bones are made up of two kinds of matter. These are called *animal matter* and *mineral matter*. The animal matter makes bones tough and keeps them from breaking easily. The mineral matter makes them hard and keeps them from bending out of shape.

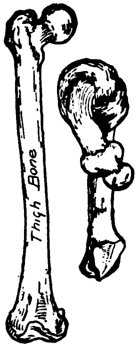

Fig. 4.—Bone tied in a knot.

If a bone is placed in a hot fire for a few hours, all the animal matter is burned out of it, and only the mineral matter is left. The bone has the same size and shape as before, but it breaks very easily. The mineral matter can be taken out of a bone by soaking it for a few days in a pint of water to which a few ounces of muriatic acid have been added. This leaves the bone very soft. If it is long and slender it may be tied in a knot (Fig. 4).

The bones of children are much softer than those of old people because they contain more animal matter. For this reason the bones of children are easily bent out of shape. The bones of old people contain more mineral matter. This makes them very brittle. The bones of old people are easily broken.

12. What Makes Bones Strong and Healthy.—A little boy used to say that peaches and plums had bones in them. The bones in a roast of beef he called stones. Children often think of bones as if they were like stones,—things without life. The bones are living things, just as our muscles are. They grow, as do all other parts of the body. To help them grow they must have *food*. To make them strong we must take *exercise*. To keep them healthy the body must have plenty of *fresh air* and *sunlight*. Proper food, exercise, fresh air, and sunlight are all necessary to keep the bones strong and healthy.

13. How Bones Become Bent.—If you plant a tree and wish it to grow straight and tall, you must train it while it is young. While it is small you can bend it in any way you wish, but you can not straighten it after it grows big.

The bones of children are easily bent because they are soft. As we grow older the bones become harder. If they grow crooked when we are young, they will stay crooked when we are old. If we wish to grow straight and tall, we must be careful not to have our bones bent out of shape while we are growing.

There are many ways in which children's bones may be bent out of shape. People often do a great deal of harm by trying to make a baby stand up before its bones are hard enough to support its weight. This is a common cause of bowlegs. The most common cause of crooked bones is a *bad position* in sitting and standing. If boys and girls slide down in their seats at school, hang their heads and let their shoulders droop when they stand, twist their backbones to one side and let their chests curve in when they sit or stand (Fig. 5), they are sure to become deformed. Their bones may be bent so badly that they will interfere very much with their health. They are sure to be bent so badly as to spoil their appearance.

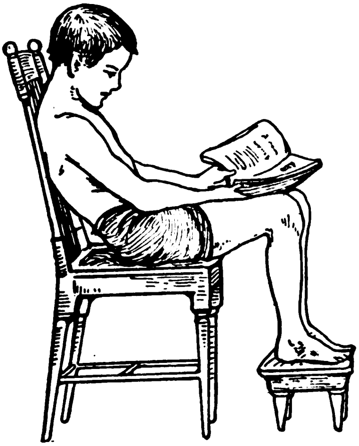

Fig. 5.—Sliding down in his seat curves his back and crowds his lungs.

When we stand or walk, we should draw the chin back and hold the head as high as possible. The shoulders should be thrown back, and the backbone held erect and straight. In standing, the weight should rest on both feet and not on one alone (Fig. 6). If we wish to grow straight and tall, we must train ourselves to do these things while we are young.

14. Effect of Deformity on Work and Health.—Flat chests and crooked backs not only spoil the appearance of boys and girls, but they interfere with their work and their health. The boy who stands erect, with chest out and shoulders back, has a better chance to get a good position than the stoop-shouldered, flat-chested boy, because employers know that he can do more work and better work and that he is not so likely to lose time on account of sickness. People whose bones are badly bent find it very hard to get any work that they can do well.

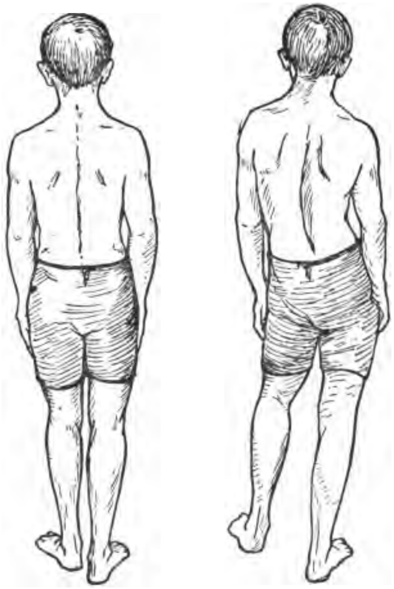

Fig. 6.—Which of these positions is better? Why?

The skeleton is the framework of the body. No piece of machinery will work properly if its framework is twisted out of shape. Your bicycle would not run well if the frame were twisted. The bones of the trunk form a sort of case which holds and protects some of the most important organs of the body. You would not expect your watch to run and to keep good time if the case were bent in on the works. You can not expect your heart, lungs, and stomach to do their work right if the bony case of your trunk does not give them enough room or if it pushes them out of their proper position. (See Figures 3 and 8.)

15. How to Prevent Round Shoulders.—Round shoulders and a flat chest are caused by weak muscles. If a boy allows his shoulders to droop and his chest to curve in when he sits or stands, the muscles which hold the shoulders back become weak and flabby. To have square shoulders and a full chest he must *train* the muscles of his back and shoulders. The only way to do this is to be careful *always* to keep his shoulders up and his back straight. If he will watch himself and make sure that he is doing this, his muscles will soon become strong enough to hold his shoulders back without his thinking about it.

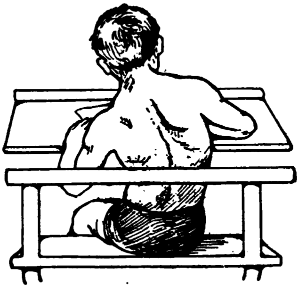
Fig. 7.—Sitting with one shoulder higher than the other twists his spine.

16. How to Prevent Curved Spine.—The spinal column is put together in such a way that we can bend it very easily in all directions. If we keep it bent too long in one direction, it is sure to become crooked. Children sometimes form the bad habit of putting one foot under them when they sit down. This twists the backbone to one side and is sure to make it crooked if they do it often. Instead of sitting erect they slide down in their seats. Another bad habit is to sit with one shoulder higher than the other. Children often do this when they are writing at a desk. Sometimes it is the fault of the desk, for school desks are often too high for the children who use them. Sitting with one shoulder higher than the other is very likely to cause curvature of the spine, because the backbone is twisted to one side (Fig. 7). We should be careful always to sit and stand erect, and to keep both shoulders at the same height.

17. How Tight Clothing Hurts the Bones.—Clothing that is too tight at the waist bends the ribs out of shape and makes the chest smaller. This is bad for the heart, the lungs, and the stomach (Fig. 8). Tight shoes make the bones of the foot crooked. The feet may become very painful. Many people suffer all through life from the effects of tight shoes. When high-heeled shoes are worn, the body loses its natural balance. This puts a great strain on the hip bones and sometimes twists them out of shape. Growing girls should never wear high-heeled shoes.

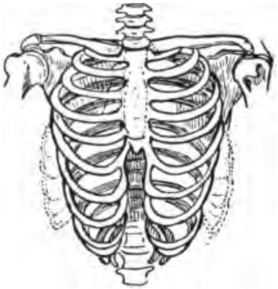

Fig. 8.—How tight clothing changes the shape of the chest. The dotted lines show the *natural shape.* (See also Fig. 3, page 17).

18. Broken Bones, Sprains, and Dislocations.—Bones may be broken by sudden blows or falls. A break in a bone is called a fracture. A broken bone will heal if it is properly cared for. The two ends will grow together again and the bone will be just as strong as before. When a bone is broken it should be set by a doctor. The two ends must be brought together and held in their proper position, so that they can grow together and give the bone its right shape after healing.

The broken ends of the bone are often very sharp and they are likely to injure the blood-vessels and the muscles. If a bone has been broken, the limb should be moved as little as possible until the doctor comes. If it must be moved, the ends should be kept in place by fastening a narrow board or a flat stick on each side of the limb with a bandage or some strips of cloth (Fig. 9). The limb should be held up, and not allowed to hang down.

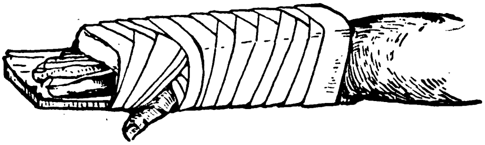

Fig. 9.—Splints for a fracture of the bones of the forearm.

A sudden twist or pull may stretch or tear the ligaments which hold the bones together at a joint. Such an injury is called a sprain. The injured joint should be kept at rest and bathed in water as hot as one can bear, or wrapped in cloths wrung out of hot water. For a severe sprain it is best to send for the doctor.

Sometimes the end of a bone is forced so far out of its place at a joint that it does not slip back again.

We say the bone is dislocated. Dislocations are most common in the upper limbs. The bone may often be put back in place by a strong, steady pull. If this does not succeed, it is necessary to have it treated by a doctor.

QUESTIONS

What is the skeleton? Of what is it made up? What is its use?

Name the parts of the skeleton.

What name do we give to the bones of the head?

Name the bones of the trunk. Give a very short description of them.

Name the cavities of the trunk, and tell what organs each contains.

What is a joint? Name the kinds of joints. Give several examples of each. What are the ligaments?

Name the uses of the bones.

Tell of what bones are made. How could you prove this?

What is the difference between the bones of children and those of old people? Of what things must children be careful? Old people?

Tell what we should do to keep the bones healthy.

Explain all the ways you know in which bones may become bent. Tell how we should stand and walk. Why must children be so careful about this?

Explain how crooked bones may interfere with our work and health.

What causes round shoulders? How may they be prevented?

Explain in what ways the spine may become bent. How can we prevent this?

Tell how tight clothing may injure the skeleton. What harm is done by high-heeled shoes?

How could you help a person who had broken a bone? What should be done for a sprain? For a dislocation?

CHAPTER III

THE MUSCLES

19. What Muscles Are.—The muscles are the lean flesh of the body. The flesh which covers the bones is made up of bundles or bands of different sizes and shapes. Each band or bundle of flesh is called a muscle. The muscles are fastened to the bones by white cords or bands called *tendons* (Fig. 10).

20. Use of the Muscles.—The chief use of the muscles is to produce motion. All the movements of the body,—walking, running, jumping, writing,—are produced by the muscles.

When a muscle is used to move any part of the body, it *contracts*, that is, it becomes shorter and thicker. When another muscle pulls the part back, the first muscle *relaxes* and becomes longer. If you will put one hand on your arm, above the elbow, you can feel the muscle contracting and relaxing as you move the forearm up and down. This muscle is fastened to the bones of the forearm just below the elbow. As the muscle contracts, it pulls on these bones and moves the forearm upward. All the movements of the body are produced by contractions of the muscles.

The muscles fill in the hollow places of the skeleton

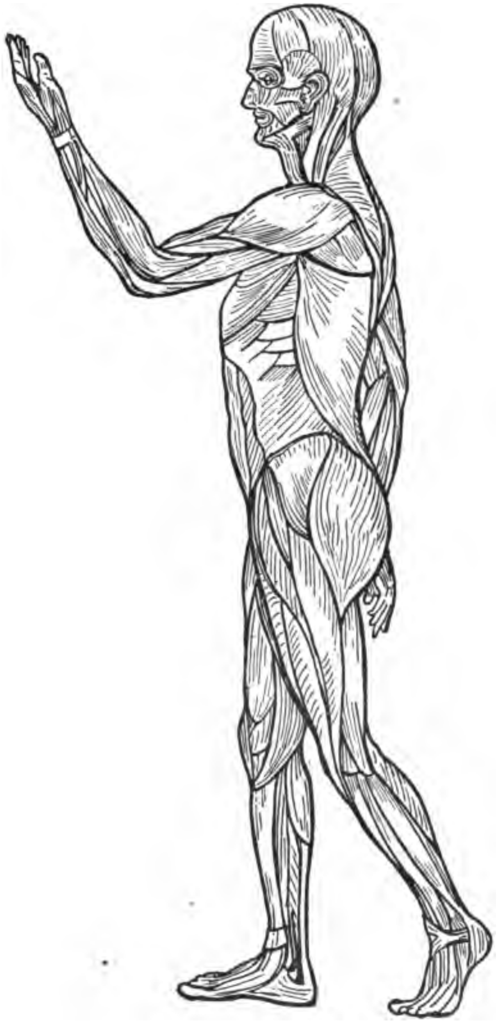

Fig. 10.—The muscles.

and help to give shape to the body. The walls of the abdomen are formed of muscles. A great deal of the heat of the body is produced in the muscles.

21. How to Keep the Muscles Healthy.—The muscles are the machinery that moves all the parts of the body. Like other machinery, they wear out and must be repaired. One of the uses of our food is to repair the worn-out parts of the muscles. Every school-boy knows that he can not be strong if he does not have enough food. To keep the muscles strong and healthy we must have plenty of good food and pure air.

22. How to Make the Muscles Strong.—The more a piece of machinery is used, the weaker it gets, until at last it is completely worn out. It is *very different* with our muscles. The more we use our muscles the stronger they grow, if we get plenty of good food and give the muscles the rest they need. Any muscle in the body can be made stronger by using it in the right way. Farmers, blacksmiths, and carpenters nearly always have strong muscles because they use them a great deal in their work. People who do not use their muscles in their work must take some *exercise*, like walking, swimming, or rowing, to keep their muscles strong and healthy.

23. Effects of Exercise on the Body.—You have noticed that when you run hard you soon get "out of breath." You must breathe much faster than when you are sitting still. The body must have more air, and the lungs must work faster. You may have noticed, too, that when you run a long distance you can often feel your heart beating in your chest. If you put your finger on your wrist and feel your pulse, you will find that it is much faster when you have been running than when you are sitting still. The muscles must have more blood when you are using them, and the heart must work faster to send it to them. The right kind of exercise is just as good for the heart and the lungs as it is for the muscles.

Another thing that you have all noticed is that you get very warm when you run, and that the skin soon gets wet with perspiration or sweat. If we do not get chilled afterward, this is good for the skin. People who take plenty of exercise nearly always have a nice, clear skin. Perspiration contains waste matter that poisons the body if we do not get rid of it. Plenty of exercise helps the body to throw off this waste matter through the skin.

Exercise also gives people a good appetite. You have all noticed that you eat more when you have been using your muscles a great deal. The right kind of exercise is good for every part of the body. We can not have healthy bodies unless we use our muscles regularly.

24. Amount of Exercise.—It is not easy to tell just how much exercise we should take. Some people need more than others. If we exercise as much as we should, we are sure to feel more or less *tired;* but this tired feeling will pass off in a short time unless the muscles have worked too hard or too long. If we do not feel fully rested after a night's sleep, we may be sure that we have had more exercise than is good for us. Most people need at least as much exercise every day as would be equal to a five-mile walk in the open air.

25. Dangers of Too Much Exercise.—If you were to weigh yourself just before running a long race and again after the race, you would find that you weighed less after the race than before. The reason for this is that part of your muscles has been used up in running. The muscles have been wearing out. With plenty of good food, the muscles are soon repaired again. When they are fully rested they will be a little heavier than before the race. But if you should run a long race every day, your muscles would get thin and weak, because they would wear out faster than the body could build them up. Too much exercise makes muscles thin and weak, instead of making them strong.

There are some kinds of exercise about which children must be very careful. Any game or sport that makes the muscles work very hard for a long time is sure to injure the heart. Jumping rope for many minutes at a time and running long races (Marathon races and cross-country races) are very dangerous for children.

26. Best Kinds of Exercise.—The best kinds of exercise are those which use as many of the big muscles of the body as possible, like the muscles of the arms, the trunk, and the legs. For boys and girls the best kinds of exercise are outdoor games and sports like tag, baseball, tennis, bicycling, and skating. Swimming is one of the very best kinds of exercise because so many different muscles are used. Every boy and girl should learn to swim. It is splendid exercise and it may save one's own life or that of some one else. Rowing is another good kind of exercise. Walking is one of the best kinds of exercise, particularly if one learns to take deep breaths with the mouth closed.

27. Best Time and Place for Exercise.—Ordinary exercise, like walking, may be taken at any time, but we must be careful not to engage in hard exercise just before or just after a full meal. After hard exercise it is best to wait a half hour before eating. After a full meal we should wait about two hours before taking any violent exercise. The stomach is sure to suffer if these rules are not obeyed.

Exercise should always be taken in the open air if it is possible. Exercise taken indoors is never so helpful as outdoor exercise. During vigorous exercise the body throws off much more waste matter than at other times, and in a closed room this soon makes the air very impure. In the outdoor air this waste matter is promptly carried away.

28. Rest.—It is good for the muscles if we exercise until we are tired; but we must not forget that the muscles lose weight while they are working, and that it is only while they rest after working that they increase in weight and in strength. Rest is just as necessary as exercise. Exercise without proper rest does more harm than good. It tears down without building up again. Violent exercise must never be kept up very long and must not be repeated until the muscles are fully rested.

29. Physical Training and Correct Posture.— In many of the athletic sports only a few sets of muscles are used. These muscles become very strong, while other muscles are not used at all. It is much better to train *all* the muscles of the body so that they may all be strengthened equally. For this reason nearly all schools now have physical training. The physical training exercises strengthen *all* of the large muscles of the body. They really train the mind as well as the body. The mind is trained to command the muscles and the muscles are trained to obey promptly and exactly every order of the mind.

The physical exercises also train pupils in correct positions in sitting, standing, and walking. Round shoulders are really caused by weak muscles. We can train and strengthen these muscles by always holding our shoulders back when we sit, stand, or walk, and in a little while the muscles will be strong enough to keep our shoulders back without our thinking about them.

QUESTIONS

What are the muscles? What are the tendons?

Explain the chief use of the muscles. What other uses have they?

Tell how to keep the muscles healthy.

How can we make the muscles strong?

What is the effect of exercise on the lungs? On the heart? The skin? How many of these things have you noticed yourself?

How can we tell how much exercise to take?

Why does too much exercise hurt us? In what ways does it hurt us? What kinds of exercise should we avoid, and why?

Name some of the best kinds of exercise. Tell why each is good.

What care must be taken about the time for exercise? Where is the best place for exercise? Why?

Explain why rest is as necessary as exercise.

In what ways is physical training better for us than ordinary games and sports?

CHAPTER IV

HOW THE BODY WORKS

30. The Body Like a Steam-engine.—In many ways the body is very much like a steam-engine. To make the engine go we must build a fire in the fire-box, and fill the boiler with water. The fire turns the water into steam, and the steam makes the wheels go round. We put coal on the fire and water in the boiler, and get heat and power from them.

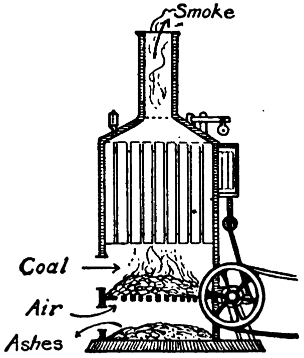

Fig. 11.—How to keep the engine going.

The fire in the engine does not burn well unless it has a good draft. To make a fire burn well, we give it plenty of *air*. If the air is all shut off, the fire will go out. To get a good draft, we must have a chimney or a smoke-stack. The chimney does two things. It draws air to the fire, and it carries off the smoke that comes from the fire.

Another thing that is necessary to keep the fire burning well is to *get rid of the ashes*. If the ashes are not removed regularly, they will soon choke the fire and put it out (Fig. 11).

31. The Fires in the Body.—You have noticed that your body is *always warm*. The heat of your body is made in just the same way that heat is made in the engine, only instead of one big fire there are millions and millions of very tiny fires spread all through the body. These little fires do not burn with a flame, like the fire in the engine. They burn much more slowly. They do not make as much heat as the fire in the engine. They burn just fast enough to keep the body at an even temperature of a little more than 98° F. Sometimes, when we are sick, they burn too fast, and we say we are feverish, or we have a fever.

The little fires that keep our bodies warm must have something to keep them going, just as the fire in the engine must have coal. The thing that keeps them going is the *food* we eat. Our food is to our bodies just what coal is to the engine. Just as the engine gets heat and power from the coal, so our bodies get heat and power from our food.

The fire in the engine must have *air*, and so must the little fires in our bodies. When we breathe we take air into our bodies to keep these little fires going. If they could not get air, they would go out at once.

The food we eat goes into the stomach. The air we breathe goes into the lungs. Most of the heat of the body is made in the muscles. That is where most of the little fires are. So there must be some way of carrying food from the stomach, and air from the lungs, to these little fires in the muscles. This is done by the blood. The blood takes up the best part of the food we eat and part of the air we breathe, and carries them to every part of the body. In this way, the little fires are kept going.

To keep a good fire in the engine, we must get rid of the ashes. The little fires in our bodies leave ashes like those in the engine. When food is burned up in the body, there is always part of it that the body can not use. This is called *waste matter*. The body must get rid of its waste matter, just as we must get rid of the ashes in an engine. Indeed, this waste matter does much more harm in the body than ashes do in an engine. If our bodies do not get rid of this waste matter, it will kill us in a very short time.

Part of the waste matter of the body is like the smoke of the engine. This is thrown out of the body through the lungs. Other parts of the waste matter are like the ashes of the engine. This waste matter must be mixed with water before the body can get rid of it. It is thrown out of the body through the skin and through the kidneys.

It will help us to understand many things about our bodies if we will remember these important facts: In many ways our bodies are like steam-engines. The engine must have *fuel*. It must have a good draft to *draw air* to the fire and to *carry off the smoke*.

The fire must be *kept clear of ashes*. In our bodies we have millions of tiny fires that burn very slowly. These fires keep our bodies warm and give us power to move and to work. If these fires go out, we die. To keep them going, we must give them fuel in the form of *food*. We must give them *air by breathing*. We must *get rid of all the waste matter* these fires leave.

QUESTIONS

What makes an engine go? What are steam-engines used for? Tell all of the things you would have to do to keep a good fire under the boiler of an engine. What are the two uses of the smoke-stack?

Why are our bodies always warm? What is the difference between the fires in the body and the fire in an engine?

Explain fully how the fires in our bodies are kept going. Where are most of these fires? Why?

How are the fires in the body supplied with fuel? With air?

What two kinds of waste matter are produced in these fires, and how does the body get rid of each?

CHAPTER V

FOOD AND DRINK

32. Food and Health.—The food we eat has a great deal to do with our health. To be perfectly well, we must eat the *right kind of food.* We must not eat too much or too little. Our food must be *clean.* It must be *properly prepared.* We must eat it at the *right time* and in the *right way.* When we think of all this, we can understand why food has so much to do with good health.

33. Two Uses of Food.—Food is burned up in the body to make heat and power, just as coal is burned in an engine. As the food passes through the stomach and the intestines, the nourishing parts of it are taken up by the blood. Each part of the body takes some of this food from the blood and stores it up until it is needed. Most of it is stored up in the muscles. Here it is burned up, a little at a time, more when we work and less when we rest. This is the first great use of food. It acts as *fuel,* to furnish heat and power.

Food has another great use. Most children can guess what it is. You are all *growing.* You are larger now than you were last year, and next year you will be larger still. It is the food you eat that makes you grow. The body needs food to *build* with, as well as food to burn up. Even grown persons need food for building, for parts of their bodies are always wearing out, and these parts must be repaired or built up again.

Food has two great uses. Its first use is to act as *fuel*, to give heat and power to the body. Its second use is to *build up* and repair every part of the body (Fig. 12).

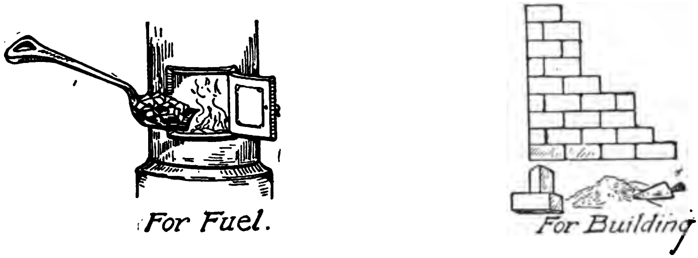
For Fuel.
For Building

Fig. 12.—The two uses of food.

34. Kinds of Food.—Foods are divided into two kinds, according to their use. They are called *fuel foods* and *building foods*. Really, all foods are used both for fuel and for building; but some foods are called *fuel* foods because they are used mostly for giving heat to the body, and other foods are called *building* foods because they are used chiefly for building up or repairing the body.

There are *two kinds of fuel foods*. The first kind consists of *sugar* and *starch*. Starch belongs in the same class with sugar because it is changed to sugar in the body. The sugar we use on our tables is made from sugar cane or from sugar beets. Nearly all fruits contain some sugar. Starch is found in most of our vegetable foods. Potatoes are made up almost entirely of water and starch. Wheat, corn, oats, and rice all contain much starch.

The second class of fuel foods consists of *fats* and *oils*. Milk contains fat in the form of cream. Butter is almost all fat. Beef, pork, mutton, and fish all contain fat. Corn and oats are rich in fat. Some of the oils used for food are olive oil and cotton-seed oil.

The most important of the *building foods* are eggs, lean meat, bread, beans, peas, oatmeal, and milk. All the different parts of the body are built up from materials that are obtained from these foods.

All of the building foods contain a substance called *protein*. There are several kinds of protein. The white of eggs is made up of a kind of protein called albumen. The protein of wheat is called gluten. The protein part of milk is called casein. Other proteins have other names. All of them are used by the body as building material. The building foods are often called the protein foods.

35. Digestion.—The blood can not take butter, eggs, milk, and bread and carry them to the muscles. All of these things must be changed in the stomach and in the intestines to make them fit for the blood. This changing of the food to make it fit for the blood is called *digestion*. When food is ready to be taken up by the blood, it has been *digested*. Some kinds of food, like milk and eggs, need to be changed very little. They are easily digested. Other foods, like pork and cabbage, are hard to digest. We shall learn more about digestion in another chapter.

36. Milk.—Milk contains all of the things that are needed by the body. It is both a fuel food and a building food. One can live a long time on milk alone. Milk is a perfect food for babies, but it does not contain quite enough nourishment for older children or for grown people. Milk is a valuable food for all persons. It is one of the best foods for young children and for people who are sick.

Butter is one of the best fuel foods we have. There is nothing better than butter to eat with bread, rice, and other starchy foods.

Cheese is a very nourishing food. It is a good fuel food and a good building food. Most kinds of cheese are easily digested if one does not eat too much of them.

37. Eggs.—The white of eggs is a splendid building food. The yolk contains a large amount of fat which makes it a good fuel food. Eggs are very nourishing; but the more an egg is cooked, the harder it is to digest. A raw egg beaten up in milk and sweetened with a little sugar makes a splendid food for children.

The white of eggs, stirred up in water, is often given to sick people who can take no other food.

38. Meats.—Most of the protein or building material that the body uses comes from meat. Meat also supplies a large part of the fat of our food. Pork has more fat than other meats. This makes it harder to digest. The flesh of chickens is rich in protein or building material and it usually has less fat than beef or pork. This makes it a very good food for invalids.

Beef and mutton are the best meats for general use. They are very nourishing and easily digested. Some cuts of beef, like sirloin steak, are much more expensive than others. The cheaper cuts are just as nourishing, and if they are properly cooked they are just as easily digested.

Mutton is often cheaper than beef and it is just as nourishing, but some people do not like its taste. Mutton broth is almost as good a food for invalids as chicken broth. Pork is a good food for those who work hard or exercise a great deal. Some people find it hard to digest.

Fish is almost as good a building food as meat; but some kinds, like mackerel, salmon, and shad, are hard to digest because they contain a great deal of oil. Shell-fish,—oysters, clams, crabs, and lobsters,—are expensive foods and do not contain much nourishment. Oysters are easily digested, especially when eaten raw.

39. Cereals.—Wheat is the most widely used grain in Europe and America. It is a good building food and a good fuel food because it is rich in protein and in starch. Bread and butter together make a splendid food.

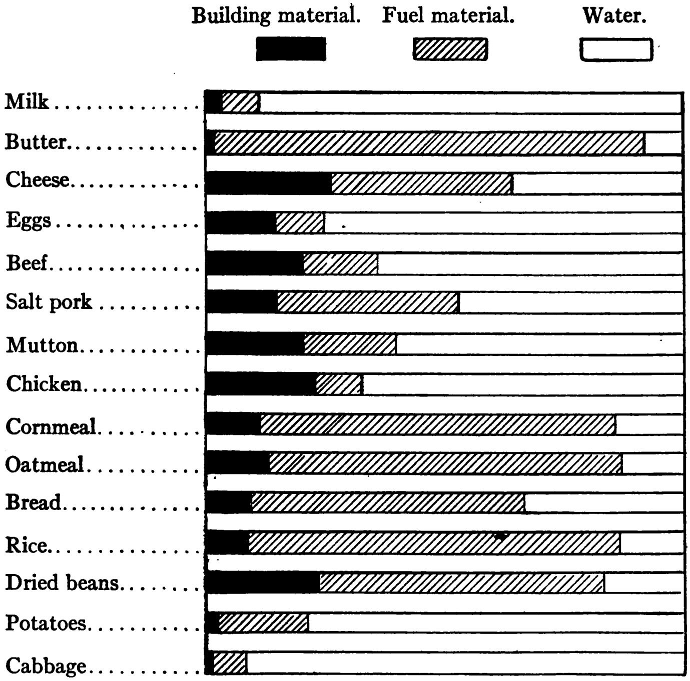

Fig. 13.—Diagram showing amount of building material and of fuel material in each of these foods.

Oatmeal has more protein than wheat bread. It has more fat than any other cereal. It is an excellent food both for fuel and for building up the body.

Well-cooked oatmeal is one of the very best foods for growing children.

Corn (maize) contains almost as much protein and fat as oats. Cornmeal is a nourishing and wholesome food. The early settlers used a great deal of cornmeal. It is a cheap food, and in some parts of our country a great deal of it is still used.

Rice is the most important food of the people of eastern Asia. Millions of people live almost entirely on this grain. It has more starch than any other grain, but less protein. It is a good fuel food but a poor building food.

40. Beans, Peas, and Potatoes.—Beans and peas are very rich in protein. They contain even more building food than most meats. If they are not cooked thoroughly they are hard to digest, and the body does not get much nourishment from them. They are much cheaper than meat and can often be used in its place.

Potatoes are more than three-fourths water. They contain a great deal of starch, but only a very little building material. Potatoes alone are a poor food. Baked potatoes, eaten with butter, or boiled potatoes with meat or meat gravy, are good foods.

41. Fruits and Green Vegetables.—Most of these are made up largely of water. There is not much nourishment in them. They help to keep the stomach and the intestines healthy, and it is well to use them with other food, especially in summer.

Only sound, ripe fruit should be eaten. Much sickness is caused during the summer months by eating unripe or over-ripe fruit. Many persons find stewed fruit more wholesome than uncooked fruit.

42. Coffee, Tea, and Cocoa.—There is no nourishment in either coffee or tea except as cream and sugar are added to them. Grown people who have to work hard, and who become very tired, often find these drinks useful; but they sometimes interfere with digestion and keep people from sleeping. Children should never use either tea or coffee. They take away the appetite for food, interfere with digestion, and make children restless and nervous.

Cocoa is made from the seeds of the cacao tree, which grows in the warm parts of America. Chocolate is made by grinding the seeds very fine and pressing the paste into cakes. It contains a great deal of oil. Part of this oil is removed in making cocoa. Both chocolate and cocoa are very nourishing. Cocoa is more easily digested than chocolate. It is an excellent drink for children.

43. Diet.—The food and drink that we take from day to day are called our *diet.* Diet has a great deal to do with health. A good diet makes us strong and healthy. A poor diet makes us weak and sickly.

The same diet will not do for all people. Children need less food than grown people. A man who uses his muscles a great deal needs more food than a man who sits still most of the day. The working-man must have plenty of *fuel food.* The man who must sit still all day at his work should not take too much fuel food. All of us need more sugar and fat in winter than we do in summer, because these things give heat to the body. In very cold countries people must have a great deal of fat.

44. Need of a Mixed Diet.—A person who did not have to work could live for a long time on milk alone, because it contains all the things that the body needs. There is no other food that forms a satisfactory diet if it is used alone. If we ate nothing but bread, we would get too much starch and not enough fat. If we ate nothing but meat, we would get no sugar or starch. If we lived entirely on rice, we would get hardly any fat and not enough building material. To keep the body healthy and strong we must have a certain amount of protein or building material, of fat, and of sugar or starch. There is no one food that will give us just the right amount of each. To get just what the body needs we must use a *mixed diet;* that is, we must use several different articles of food.

Your own appetite tells you this. Bread alone does not have enough fat. Butter supplies the fat which is needed and at the same time makes the bread taste better. Meat has no starch and only a very little sugar, so we eat bread and potatoes with it. Eggs alone do not make a good diet, but eggs and bread provide everything the body needs.

The following lists show how different foods may be used together to make a satisfactory diet.

Breakfast	*Dinner*	*Supper*
Orange.	Vegetable soup.	Beef stew.
Cereal.	Roast lamb.	Bread and butter.
Soft boiled egg.	Baked potatoes.	Milk.
Bread and butter.	Peas.	Junket or custard.
Milk or cocoa.	Bread and butter.	
	Canned peaches.	

The United States government has studied the subject of diet very carefully. This is what it gives each of its soldiers every day:

GARRISON RATION—UNITED STATES ARMY

Beef or mutton (fresh), 20 ounces; or bacon, 12 ounces. On holidays, chicken or turkey, 16 ounces.
Bread, 16 ounces.
Beans, $2\frac{2}{5}$ ounces; or rice, $1\frac{3}{5}$ ounces; or hominy, $1\frac{3}{5}$ ounces.
Potatoes, 20 ounces.
Prunes, dried apples, or dried peaches, $1\frac{1}{4}$ ounces.
Coffee, $1\frac{1}{8}$ ounces; or tea, $\frac{1}{3}$ ounce.
Sugar, $3\frac{1}{5}$ ounces.
Milk, evaporated, unsweetened, $\frac{1}{2}$ ounce.
Butter, $\frac{1}{2}$ ounce.
Salt, vinegar, pepper, cinnamon, syrup, and other articles.

45. Care of Milk and Other Foods.—Because young children live almost entirely on milk, we can not be too careful to see that the milk is pure and clean. More children under one year of age die from using poor milk than from any other cause.

Milk must be clean and it must be kept cold. Dirty milk is always dangerous. It is not fit for food. It is full of germs, and these are sure to make little children sick if they drink such milk. One should never buy milk that is dipped out of an open can into pitchers and kettles. Milk can not be kept clean if it is sold in this way. It should never be served to families except in bottles. Most cities do not allow milk to be sold in any other way. Nearly every city has inspectors to see that milk and other foods that are sold are pure.

Fig. 14.—Dirty food is dangerous.

Germs grow very rapidly in warm milk, but they do not grow at all in milk that is kept ice-cold. Milk should be cooled at once after milking, and should be kept cold until it is used. This is very important, for if milk is not properly cared for it spoils more quickly and is more dangerous than any other food.

Pasteurized milk is milk that has been heated and kept at a temperature of 150° or 160° F. for twenty minutes. Heating the milk kills all the germs in it, but it will not prevent germs from growing in it again if it is exposed to dust and is not kept on ice.

The germs of typhoid fever, scarlet fever, and diphtheria may get into milk from the hands or the clothing of persons who handle the milk. No one should be allowed to handle milk if he has any of these diseases or if he is taking care of any one who has a contagious disease.

Fig. 15.—Foods should be kept away from dust and flies.

Food that is not perfectly clean is not fit to eat (Fig. 14). Vegetables that are eaten raw, like lettuce and celery, and all kinds of fruit should always be washed thoroughly before they are used. One should never buy any food that is exposed to dust or to flies. Dust and flies always carry germs, and food is not safe to eat if dust and flies can get at it (Fig. 15). Food should not be touched with the hands if it can be avoided. When it must be handled, the hands must be perfectly clean.

Fish and meat are dangerous if they have begun to decay. In warm weather they must be kept on ice. The ice-box or refrigerator must be kept perfectly clean.

46. Common Mistakes in Diet.—The three common mistakes people make in their diet are eating too much protein or building food, eating too little protein, and not eating enough fat.

Eating too much protein is a fault of the rich. Most people like the taste of protein foods best, and those who can afford to eat whatever they like are apt to live largely on protein foods. Eating too much meat may cause kidney trouble and other diseases.

Poor people often do not get enough protein food. The starchy foods are usually much cheaper than meat, and the poor often live almost entirely on these foods. In some countries of Europe and Asia, the working people eat little or no meat. People who live almost entirely on vegetable food usually do not get enough protein or fat. Many children suffer from lack of protein food. They can not grow as they should if their diet does not contain enough building material.

Fat is by far the best fuel food we have. An ounce of fat will give more than twice as much heat and power as an ounce of sugar or starch. To keep strong and healthy, the working-man should not eat too little fat.

47. Cooking.—Cooking improves the taste of food, makes it easier to digest, and kills any disease germs that may be in it.

All starchy foods must be cooked thoroughly. The tiny grains of starch are surrounded by tough envelopes of a woody substance. It is almost impossible for the stomach to digest uncooked starch. Cooking makes the grains of starch swell until they burst the tough envelopes around them, and this makes the starch much easier to digest. The longer starchy foods are cooked, the easier they are to digest.

Protein foods, however, should not be cooked too long. You know what happens to the white of an egg when you put it in boiling water. Cooking acts in the same way on all proteins; it makes them hard and tough, so that they are not so easily digested.

Broiling is the best way to cook steaks or chops. They should be cut thick, and the fire must be very hot. This makes the outer layer of the meat turn hard at once and forms a coating which keeps in the juices of the meat. To roast meat properly, the oven must be very hot when the meat is put in, so that all the juices may be kept in the meat, as in broiling.

The best way to cook the cheaper cuts of meat is to boil them. The water should be boiling when the meat is put into it, so that the protein on the outside of the meat will turn hard and keep in the juices and the flavor of the meat. After ten or fifteen minutes, the water should fall a little below the boiling point and be kept at that heat until the meat is tender. If the water is kept at the boiling point too long, all the protein turns hard and makes the meat tough.

In making soups, broths, and stews, we want to get all the flavor and the juices out of the meat. In this case, the meat should be cut into small pieces, placed in cold water, and heated slowly.

Frying, if it is properly done, is really boiling in oil or in lard. The reason for using oil and lard is that these can be made much hotter than boiling water. When meat or fish is placed in boiling oil or lard, the protein on the outside turns hard instantly. This keeps in all the juice and flavor of the meat, and at the same time keeps the fat from soaking in. The oil or lard must be deep enough to cover the food and must be kept very hot.

QUESTIONS

Explain how our health depends on the food we eat.

Explain fully the two uses of food.

Name the two kinds of fuel foods and tell from what things each is obtained.

From what foods does the body obtain its building material? What are the building foods often called? Why?

Explain what is meant by digestion.

Why is milk a valuable food? Is it a perfect food for everybody? Tell why. For what is butter valuable? Cheese?

For what are eggs valuable? In what ways are they used? What difference does cooking make?

What two things do we get from meats? Name the meats in common use. Tell which are best for general use, and why. What makes the flesh of chickens a valuable food? For what is pork valuable? What can you say of the food value of fish? Shell-fish?

Name the common cereals and compare them as to their food value. Which are good fuel foods? Good building foods?

What food value have beans? Peas? Potatoes?

Why are fruits and green vegetables valuable? What care must be taken in eating fruit?

Should children drink tea or coffee? Why? How does cocoa differ from chocolate? Is it a good food for children?

What is meant by diet? Name a few of the things on which our diet depends.

What is meant by a mixed diet? Tell why a mixed diet is necessary. Make a list of foods that you think would make a good mixed diet.

Explain fully how milk and other foods must be cared for. What diseases may be caused by impure food?

What are some of the common mistakes in diet?

Why do we cook food? Why must starchy foods be cooked thoroughly?

What kind of foods should not be cooked too long? Why?

Name some of the common ways of cooking. Tell for what foods each is used. How should each be done, and why?

CHAPTER VI

ALCOHOL, TOBACCO, AND OPIUM

48. How Alcohol is Made.—Grapes, peaches, blackberries, and other fruits are *sweet* when they are ripe because they all contain *sugar*. If the juice is pressed out of the fruit, the juice is sweet because it has sugar in it. If this juice is allowed to stand in a warm place for a number of days, it loses its sweet taste. Its taste becomes sharp and biting. Something has happened to the sugar.

Fruit juice that is allowed to stand open to the air in a warm place will "work" or *ferment*. Tiny bubbles of gas form in it and come to the top. In a few days the juice loses its sweetness and has a sour, or a sharp, biting taste. The sugar that was in the fresh juice has been changed to something else. Part of the sugar is turned into a gas and the rest is changed into a clear liquid called *alcohol*. The gas escapes into the air, but the alcohol stays in the juice; and it is this alcohol that gives the fermented juice its sharp, burning taste.

When fruit juice ferments, it turns into *wine*. Wine is usually made from grape juice; but the juice of other fruits, like blackberries, can be used also. All kinds of wine have alcohol in them, no matter whether they are bought or made at home. Some kinds of wine are about one-fourth alcohol.

49. Alcohol Made from Grain.—All grains contain *starch*. When starch is taken into the body as a food, it is turned into sugar before the body uses it. Starch can also be turned into sugar outside the body. If corn, rye, or barley is moistened with water and kept in a warm place, it will *sprout*, that is, it will begin to grow into a plant. Whenever grain begins to sprout, the first thing that happens is that the starch in the grain turns into sugar. This sugar can be used to make alcohol, just as fruit sugar is used. The grain that has begun to sprout is ground up fine and mixed with water. The water melts all the sugar out of the grain. When this liquid ferments, the sugar turns into gas and alcohol, just as the sugar of the grape juice does.

Barley is used to make beer, ale, and porter. Whisky is made from corn and rye, sometimes from potatoes. Rum is made from fermented molasses.

50. Alcohol and Health.—If a man takes a large amount of strong drink, it first seems to *excite* him. He talks loud and fast. He thinks he feels stronger, and he imagines he can do more work. In a short time the excitement becomes so great that he can not control his movements. He can not walk straight. He can not talk plainly. He does not know what he is saying or what he is doing. In the end he becomes entirely unconscious. He can not stand or walk. He neither sees nor hears anything. It is impossible to waken him. He is "dead drunk."

The man who is "dead drunk" has been *poisoned* with alcohol. Men do not get drunk unless they take a pretty large quantity of alcohol, and many men think that the use of strong drink does not hurt them if they do not take enough to make them drunk. Most men who begin to use strong drink regularly do take too much after a while, because the taste for alcohol grows so that they are not satisfied with a small amount. But even if they take only a small quantity every day, it is sure to injure the health in time.

If you have ever tasted whisky, you know how it burned your mouth. The lining of the stomach is just as delicate as that of the mouth. Alcohol is sure to injure it. The man who uses strong drink regularly is surely hurting his stomach, even though he may not feel it for years. His food is not properly digested, and his body is not so well nourished as it should be.

Beer-drinkers are often stout and look strong. When their big muscles are tested, they are nearly always found to be very weak for their size. The reason they look strong is that beer causes a great deal of fat to be formed in and around the muscles. This fat weakens the muscles. Strong, healthy muscles do not have much fat. The fat muscles of the beer-drinker are neither healthy nor strong. Young men who are training for athletic contests are not allowed to use alcoholic liquors. Their trainers know that alcohol will make them weaker instead of stronger.

The most dangerous thing about the regular use of strong drink is its effect on the heart and the kidneys. Physicians know that the use of alcohol is the most common cause of heart disease and kidney disease. These diseases kill thousands of men between the ages of fifty and sixty who might have lived many years longer if they had left alcohol alone.

The use of alcohol injures every part of the body. A man can not be healthy if he gets drunk every week or two, or if he takes just a few drinks every day.

51. The Alcohol Thirst.—People give many reasons for taking alcoholic liquors. In winter they take them to keep warm; in summer, to keep cool. Many men really believe that alcohol makes them strong. Others think they can do more work if they drink beer or whisky. None of these reasons has any truth in it. Alcohol does not help one to keep warm. Arctic explorers have learned that their men can stand very cold weather much better without alcohol than with it. In our own country the men who freeze to death in winter are nearly always men who have been drinking. When it is very hot in summer, those who use alcoholic drinks are much more likely to have sunstroke than those who do not use them.

The real reason that many men use strong drink is that they have such a thirst for it that they can not stop using it. They begin by taking a drink now and then. Perhaps they do not like it at first, but they take it because their friends do. They soon get to like the taste of it. Then they begin to want it. They are always thirsty for it. When one is thirsty for water, a few drinks will satisfy him; but the alcohol thirst is different. The more liquor a man drinks, the more thirsty he grows and the more strong drink he wants. Men do not wish to be drunkards, but when they begin drinking they can not stop. They become slaves to the terrible alcohol thirst. They will do anything, even to killing other people, to get the liquor they crave.

52. Alcohol and Crime.—The man who is drunk does not know what he is doing. He is nearly always in bad company, and he will do anything they tell him. Men who are honest when they are sober will steal when they are drunk. Many murders are committed by men who are too drunk to know what they are doing. Thousands of men are sent to jail every year because they have been led into crime by alcohol. Alcohol seems to change the character of men who use it constantly. It makes them selfish, unkind, and brutal. They become lazy, untruthful, and dishonest.

53. Alcohol Makes Men Poor.—When a man has the terrible alcohol thirst, he will do anything to get his liquor. He will go without food and without clothes rather than without his drink. He will spend all his money in the saloon and let his family starve. The people of this country spend over $600,000,000 for alcoholic liquor every year. This is enough to pay the wages of nearly half a million men, giving each man $25 every week. All this money is wasted!

The drinking man must nearly always work for low wages. It is hard for him to get any kind of work, because he can not be trusted. Men who drink earn less than sober men do, and they waste a great deal of the money they do earn. More people are made poor by strong drink than by anything else.

54. The Only Safe Rule.—Nobody wishes to be a drunkard, yet there are thousands of drunkards. Nearly all of them began by taking a drink now and then. They were all sure that they could stop drinking whenever they wished. Most of them will tell you now that they can stop drinking when they want to. But they never do stop. They can not stop. The thirst for alcohol is so strong that it drives them to drink even when they know it is killing them. The same thing may happen to every person who begins to use alcoholic liquor. No one can be sure that he will not become a drunkard if he once tastes liquor. The young man who begins by taking a glass of beer or a drink of whisky every day is almost sure to become a drunkard in the end. There is only one safe rule, and that is *never to taste strong drink*.

55. Tobacco is a Poison.—Tobacco is made from the leaves of the tobacco plant. The plant is four or five feet high, and the leaves are often one and one-half feet long. The plants are cut in the fall, and the leaves are dried very carefully. They are then made into cigars, smoking tobacco, and chewing tobacco.

Tobacco nearly always makes boys sick the first time they smoke it or chew it. Florists use it to kill the insects on their plants. They burn tobacco in their greenhouses, and the smoke soon kills the insects. Sometimes they boil the tobacco in water and sprinkle this water over their plants.

The reason tobacco kills insects and makes boys sick is that *it is a poison.* The tobacco leaf contains an oily fluid called *nicotine.* Nicotine is a deadly poison. A single drop of it will kill a dog. There is enough nicotine in a strong cigar to kill a man if he took all of it into his stomach.

56. The Tobacco Habit.—The first time boys use tobacco it makes them sick. If they keep on using it, the body becomes used to the poison. Tobacco is like alcohol in one way. People who use it regularly not only get used to it but they come to like it. They feel that they must have it. They become slaves to tobacco just as other men become slaves to alcohol. Often they know that tobacco is hurting them, but they can not stop using it.

About $500,000,000 is spent for tobacco in this country every year. In most parts of our country a splendid big schoolhouse can be built for $100,000. The money that is spent for tobacco every year would build 5000 such schoolhouses (Fig. 16). We spend enough money for tobacco every year to pay the whole cost of the Panama Canal and build a lot of battleships besides.

Fig. 16.—We pay more for tobacco than for school taxes. The money spent for tobacco would build 5000 schoolhouses like this every year.

57. Tobacco and Health.—Some men use tobacco all their lives and think it does not hurt them. It does not hurt men as much as it does boys, but it never does any one any good, and it does hurt nearly every one who uses it in some way, though he may not know it.

No matter how tobacco is used, some of the poison gets into the body. The smoke of tobacco has nicotine in it, and some of this poison gets into the blood every time tobacco smoke is drawn into the mouth. Smoking makes the mouth and throat very dry.

It causes a disease called "smoker's sore throat." It often hurts the stomach and causes indigestion. It spoils the appetite. Men who smoke a great deal generally do not take enough food and they can not digest what they do take. In this way the whole body suffers.

Those who smoke a great deal nearly always have weak lungs. They can not take enough air into their lungs to keep their bodies perfectly healthy, and they are more likely to get some disease of the lungs like consumption or pneumonia than men who do not use tobacco.

Nicotine is a poison that hurts the *nerves* more than any other part of the body. Tobacco makes the muscles unsteady, so that one can not do any fine work. The reason for this is that nicotine poisons the nerves which control and regulate the muscles. Sometimes it kills the nerves of the eyes and makes people blind. One of the worst things that tobacco does is to poison the nerves of the heart. This makes the heart weak and irregular. Doctors call this the "tobacco heart."

58. How Tobacco Acts on Boys.—Tobacco never does anybody any good. It is bad for men, but it is very much worse for boys. Boys who use tobacco seldom grow as other boys do. They are nearly always smaller than boys of the same age who do not smoke. Their health is poor. They are always complaining that they do not feel well.

Tobacco hurts boys' *minds* even more than their bodies. The boy who smokes is always slow in his studies. Very often he is two or three grades below other boys of his age. In school he is lazy, cross, and restless. When a boy begins to smoke, he is pretty sure to turn out a bad boy. The use of tobacco always leads boys into bad company. They soon learn to lie and to steal. Very often people who hire boys to work for them will not take any boy who smokes. They know that he is a poor worker, and that he can not be trusted.

59. Cigarettes.—Of all the forms in which tobacco is used cigarettes are the worst. They do a great deal more harm than cigars and pipes. One reason is that they are cheap, and boys who learn to smoke nearly always begin with cigarettes. They are not so strong as cigars, and the smoke is often drawn down into the lungs. Nearly all cigarette smokers are "inhalers." When tobacco smoke is drawn into the lungs it does a great deal more harm than when it is only taken into the mouth. When paper and tobacco are burned together the smoke is much more poisonous than when tobacco is burned alone.

Men who use cigars or pipes often smoke only once or twice a day. Those who smoke cigarettes often use a dozen or more every day. The cigarette is a short, easy smoke, and it seems as if boys and men can not get enough when they once begin to use them.

So much harm is done by cigarettes that some states have made laws that they must not be sold or given to any one,—not even to men. In many states it is against the law to sell cigarettes or cigarette papers to boys.

60. Effect of Alcohol and Tobacco on the Growth of the Bones.—Boys often begin to smoke because they think it makes them look big. Smoking does not make them big. It keeps them from growing big, in most cases. Tobacco is a poison. People who raise flowers use it to kill the insects on their plants. Sometimes it kills boys, too; but usually it just poisons their bodies enough to keep them from growing. In most colleges and in some grammar schools, the boys are weighed and measured every year. The men who do this work say that boys who smoke do not grow as fast as other boys do. The use of tobacco keeps their bones from growing as they should.

There are not many schoolboys who use strong drink regularly. Those who do suffer much more from its effects than men do. Alcohol is more poisonous than tobacco. Boys who use it hardly ever grow like other boys do. Alcohol stunts the growth of the bones, just as tobacco does.

61. Effect of Alcohol and Tobacco on the Muscles.—Alcohol and tobacco hinder the growth of the muscles just as they check the growth of the bones. Both of them poison the nerves which govern the muscles, and the muscles become unsteady and shaky, so that a man can not do any fine work. If a man takes much strong drink it makes his muscles so unsteady that he can not even walk.

Alcohol turns part of the muscles to fat, and this makes the muscles weak, though they may look big and strong. Those who train students for the athletic teams in our colleges do not allow them to use strong drink or tobacco because they know these things hurt their muscles.

62. Opium.—Opium is a powerful drug. It is used by physicians to relieve pain and cause sleep. *Laudanum* and *paregoric* both contain opium. *Morphine* is made from opium and is much stronger than opium itself. *Cocaine* is another drug used to deaden pain.

All of these things may, in a few weeks, produce a *habit* that is much worse than the alcohol habit. Even physicians must be very careful in using them. Many of the *patent medicines* advertised in the newspapers contain opium or alcohol. Never use medicine without the advice of your own physician. Your doctor can tell you what medicines it is safe for you to take without sending for him. Morphine and cocaine are so dangerous that a law has been passed to keep people from getting them without a doctor's order.

QUESTIONS

What happens to fruit juice when it is allowed to stand in a warm place? What causes the change in its taste?

Explain how alcohol is made from grain.

What happens to a man who takes a large amount of strong drink?

Why do beer-drinkers often look stout and strong? Did you ever see a good baseball player who was very fat?

What is the most dangerous thing about the regular use of alcoholic liquor?

What reasons do men give for drinking liquor? What do you think of these reasons? Explain the real reason. How does the thirst for alcohol differ from the thirst for water?

Show how alcohol leads men into crime.

Tell how alcohol makes men poor.

What is the great danger in taking a drink "now and then"? What is the only safe rule? Why?

If a man drinks a ten-cent bottle of beer every working day and two bottles every Sunday, how much money does he spend for beer in a week? In a year (52 weeks)? How many pairs of shoes could he buy with this money, at $3.00 a pair? How many suits of clothes could he buy, at $13.50 each? If he stops drinking and puts this money in bank every week, how much will he have at the end of 10 years?

Do you think tobacco is a poison? Give your reasons. What is nicotine?

How much money is spent for tobacco every year? Why do so many men use it? Did you ever hear of a man who thought it hurt him to *stop* using it?

Tell how tobacco may hurt those who use it. What is its effect on boys? Why do some states forbid the sale of cigarettes?

What is the effect of alcohol and tobacco on the growth of the bones?

Tell how alcohol and tobacco injure the muscles.

What is the danger in the use of opium and cocaine?

CHAPTER VII

DIGESTION

63. What Digestion Is.—The food we eat is used to nourish every part of the body. The nourishing parts of the food become part of the blood, and each part of the body takes from the blood what it needs.

To become part of the blood, our food must be changed in a number of ways. Solid food must be turned into a liquid, and even liquid food like milk must be changed before it can become part of the blood. All these changes taken together are called digestion. The purpose of digestion is to make the food ready for the blood and to prepare it for the use of the body.

64. The Organs of Digestion.—Any part of the body that has some special work to do is called an *organ* of the body. Those parts of the body that make the food ready for the blood are called the organs of digestion. The principal organs of digestion are the *mouth*, the *stomach*, and the *intestines*. The food passes from the mouth to the stomach through a narrow tube called the *gullet* or the *esophagus*. From the stomach the food passes into another narrow tube called the *intestines*. The intestines are about 25 feet long. They are coiled up in the abdomen. The mouth, gullet, stomach, and intestines together (Fig. 17) form a tube or canal about 30 feet long. It is often called the food tube. The food tube is made up largely of muscle fibers. As these muscle fibers contract, they keep the food moving along from the gullet to the stomach and from the stomach to the intestines.

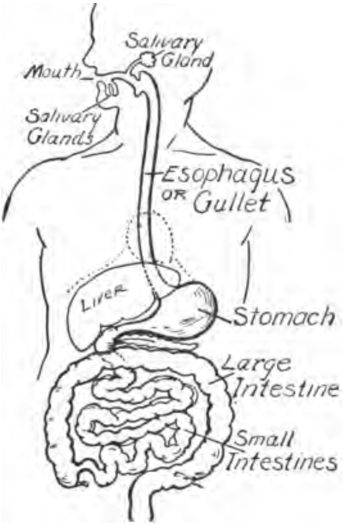

Fig. 17.—The organs of digestion.

65. How Food is Changed in the Mouth.—In the mouth the food is cut and ground by the teeth until it is broken up into very small pieces. At the same time it is mixed with a fluid called *saliva*. The saliva keeps the mouth moist; it moistens the food and makes it easier to swallow. The saliva also changes some of the starch to sugar.

66. The Stomach.—The stomach is the widest part of the food tube. It is a sort of bag or pouch in the upper part of the abdomen, just below the end of the breast bone. The walls of the stomach are made up of thin layers of muscle. When the stomach is empty its sides lie against each other, like the sides of an empty sack. When food is taken into the stomach, the layers of muscle contract and give the stomach a slight churning motion. The inside of the stomach has a soft pink lining. From this lining comes a thin watery fluid called the *gastric juice.*

67. How Food is Changed in the Stomach.—The churning motion of the stomach helps to break up the food, and mixes it with the gastric juice. This juice contains a substance called *pepsin.* The pepsin acts on the protein part of the food and changes it so that it can become part of the blood. Food is kept in the stomach from one to five hours before it passes into the intestines.

68. How Food is Changed in the Intestines.—Some of the starchy part of the food is changed to sugar in the mouth. A large part of the protein is digested in the stomach. In the intestines, *all* the kinds of food are digested. Here the food is mixed with the *bile* and other juices that act on the protein, on the starch, and on the fat. The food is changed into a creamy fluid, and all of the nourishing part is made ready for the blood.

69. How Food Gets Into the Blood.—The intestines have a soft velvety lining which is full of tiny blood-vessels. All the food has now been changed into a fluid as thin as milk. The tiny blood-vessels in the lining of the intestines take up all the nourishing part of the food. You know how a piece of blotting paper will take up or *absorb* a drop of ink. The blood-vessels in the lining of the stomach and the intestines *absorb* the food in the same way. They also absorb a large part of the water that we drink. The water and the food become part of the blood.

70. The Teeth.—The teeth are the hardest substances in the body. They never grow any larger after they are once formed. All other parts of the body grow larger year after year until they reach their full size, but the teeth do not. This is the reason we must have *two sets* of teeth, for the teeth we get when we are babies would be too small when we are grown.

There are only 20 teeth in the first set. These are called the *milk teeth.* When children are about seven years old the milk teeth begin to drop out, and the teeth of the second set take their place. There are 32 teeth in the second set.

The teeth are not all alike. They have different shapes because they are used for different purposes. The front teeth have sharp edges for cutting or biting off the food. They are called the *incisors*, the cutting teeth. The back teeth have broad, uneven tops for grinding the food. They are called the *molars* or grinding teeth (Fig. 18). The outside of each tooth is covered with a very hard white substance called *enamel.*

71. Care of the Teeth.—If you cut your finger it will heal in a short time. If a bone is broken the two ends will grow together again and the bone will be just as strong as before. If the teeth are injured they never heal, like other parts of the body do. This is one reason why we should take special care of our teeth.

Another reason for taking care of the teeth is that we can not have good digestion without good teeth. Food can not be digested in the stomach unless it is ground fine in the mouth. When the teeth are bad, food can not be chewed as well as it should be, and the stomach can not digest it properly.

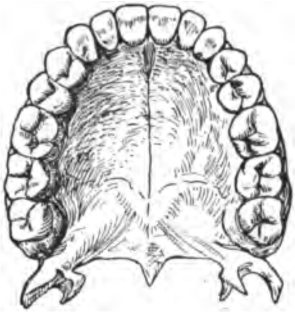
Fig. 18.—The teeth.

The enamel is very brittle. It is easily cracked; and when this happens, the tooth will decay. It soon becomes useless, and it may become very painful. One should never bite thread or crack nuts with the teeth, or pick them with pins. All of these things are likely to break the enamel.

If hot water is poured into a cold glass, or ice water into a warm glass, the glass is likely to break. Very hot drinks and very cold drinks act on the enamel of the teeth in the same way. One should be particularly careful not to change suddenly from hot to cold drinks.

If bits of food are left between the teeth after eating, they soon decay; and as they decay, they injure the enamel and eat little holes in it. Then the tooth decays, just as if the enamel had been cracked. To prevent this, *the teeth must be kept clean.* They should be brushed thoroughly every day, using a soft brush and a good tooth powder. It is best to brush the teeth both in the morning and at night. Make sure that you clean all the teeth, the back teeth as well as the front teeth. Brush the inner surface as well as the outer surface. Rub the brush up and down as well as sidewise, so that all the dirt may be removed. The brush itself must be kept clean. After you have used it, wash it out thoroughly in clean water and put it in a clean place where it will not get dusty or dirty.

Disease germs are often found in decayed teeth. Bad teeth help to cause some of the most serious diseases. It is likely that the germs of consumption, tonsillitis, and other diseases are often carried into the body from decayed teeth and unclean teeth.

The teeth should be examined at least once a year by a dentist. If there are any holes in the enamel, the dentist can fill them and keep the tooth from decaying. The first set of teeth should be cared for just as well as the second set. They should be kept clean, and if they begin to decay they should be filled to preserve them until the teeth of the second set take their place.

72. Eating and Health.—We should eat slowly and chew our food well. Unless food is chewed very fine, the gastric juice can not act on every part of it, and some of it is not digested. Eating in a hurry is a common fault in our country. The man who will not take time to eat slowly is nearly always complaining that his stomach is "out of order." His stomach would not be out of order if he treated it properly.

People who eat too fast are very likely to eat more than they should. Even those who eat slowly may take more food than is good for them if they keep on eating after their hunger is fully satisfied. Children often "stuff" themselves with cake and candy after they have had a full meal, just because they like the taste of these things. It is very harmful to take more food than the body needs. Overeating is a common cause of headache and indigestion. The stomach and intestines are overworked. The body must get rid of a lot of material which is of no use to it, and the organs which get rid of the waste matter of the body all suffer from this.

People who eat very rapidly often take big drinks of water to wash down their food. This is harmful because the food is swallowed without being properly chewed. Drinking water with our meals is not harmful. The body needs a great deal of water, and we may drink it freely with our meals if we are careful that we do not use it to wash down food that is not well chewed. We should not drink a great deal of ice water with our meals. It chills the stomach and hinders digestion. Iced drinks should always be sipped slowly.

73. Time for Eating.—Babies must be fed every three or four hours, but children over six years old do not need more than three meals a day. Like other organs of the body, the stomach must have time for rest. Meals should be eaten at regular hours. Children should not eat between meals. When they do, they have no appetite for their regular meals, and the stomach can not do its work right when it is kept at work all the time. A glass of milk about the middle of the forenoon and the middle of the afternoon will do no harm. Eating candy and cake between meals is particularly bad. Many children are always in poor health because they do this. It is very much better to eat sweets only at the close of a meal.

When digestion is going on, the stomach must have an extra supply of blood. One should not do any hard work or take any violent exercise just before or just after eating. Work and exercise draw the blood into the muscles, away from the stomach. It is best to rest for a short time before eating a full meal and for an hour after it.

74. Influence of the Mind on Digestion.—One of the greatest helps to good digestion and good health is a *cheerful mind*. You all know how the *thought* of some tempting dish makes the saliva flow when you are hungry. The same thing is true of the gastric juice. The more we enjoy our meals, the more easily they are digested, because the saliva and the gastric juice flow so freely. If we are worried or angry when we eat our meals, it is very difficult for the stomach to digest the food, because very little gastric juice is mixed with it. Worry will soon upset the strongest stomach. We should make it a life-long rule always to lay aside all care and worry when we sit down to our meals, and to make the dinner hour the happiest time of the day.

75. How Alcohol Hurts Digestion.—If you will pour a little alcohol or some strong whisky on a raw egg, you will notice that the white of the egg (albumen) becomes thick and tough. Alcohol acts on all protein foods in the same way. It makes them tough and hard to digest.

The stomach and the intestines have a delicate pink lining. When alcohol is used for a long time, the lining of the stomach and of the intestines becomes thick, hard, and dry. Food is not digested or absorbed as it should be. The drunkard nearly always complains of a bad stomach.

76. How Tobacco Hurts Digestion.—Tobacco has such a hot, burning taste that it causes large quantities of saliva to be poured out in the mouth. The glands that make the saliva are overworked, and they soon become so weak that they can not make enough saliva. The mouth and the throat become very dry. When tobacco is used regularly, it often weakens the stomach and interferes with digestion.

QUESTIONS

Explain what is meant by digestion.

What is an organ? Name the principal organs of digestion.

How is food changed in the mouth?

Describe the stomach. What is the gastric juice?

Tell how food is changed in the stomach.

How is food changed in the intestines?

Explain how food gets into the blood.

Describe the teeth.

Give several reasons for taking special care of the teeth. Tell fully how to take care of the teeth.

Give some rules for eating, with the reason for each. What are some of the effects of overeating? Should we drink water with our meals?

Show how the mind may help or hinder digestion. What does this teach us?

What rules should be followed as to the *time* for eating?

What is the effect of alcohol on the stomach and on digestion?

How may tobacco interfere with digestion?

CHAPTER VIII

THE BLOOD

77. The Blood.—The blood is a red fluid, a little thicker than water. It is carried to all parts of the body through a set of tubes called blood-vessels (Fig. 19).

If you could look at a drop of blood through a microscope, you would see a large number of tiny round bodies floating in a clear yellow fluid. These tiny bodies are called *cells* or *corpuscles*. A few of them are white, but most of them are red (Fig. 20). It is the red cells that give the blood its red color. The yellow fluid in which the corpuscles float is called the *plasma*.

78. Uses of the Blood.—Every part of the body must have a regular supply of food. It gets this from the blood. The blood takes up the nourishing part of the food in the stomach and in the intestines, and carries it to every part of the body.

To burn up this food in the body, and get heat and power from it, we must have air, and part of the air we breathe must be carried to every part of the body. The part of the air that is used in burning is called

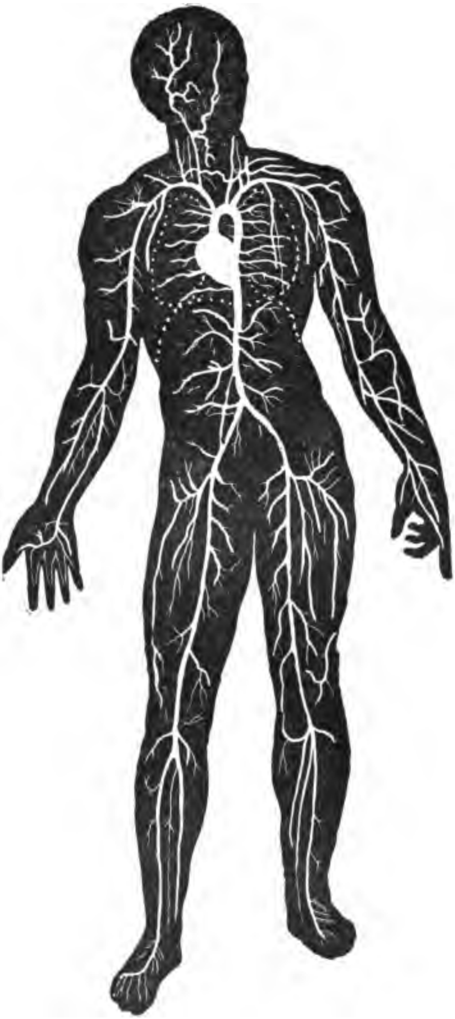

Fig. 19.—The heart and the arteries.

oxygen. The red cells of the blood take up oxygen in the lungs and carry it to all parts of the body.

When food is burned up in the body, it leaves *waste matter* which must be removed. This waste matter is carried away by the blood.

Most of the heat of the body is made in the muscles. This heat is carried to all parts of the body by the blood, so that the whole body is heated evenly. If the blood stops flowing to any part of the body, that part soon loses its heat and becomes cold.

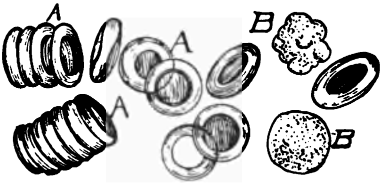

Fig. 20.—Blood corpuscles: *A*, Red cells; *B*, white cells.

The blood has four important uses:

1. It carries nourishment to every part of the body.
2. It carries oxygen to every part of the body.
3. It carries away waste matter from every part of the body.
4. It distributes the heat of the body.

79. Coagulation and Its Use.—When blood first flows from a wound, it is entirely fluid; but in a few minutes it *coagulates*, that is, it becomes thick and sticky. It changes to a jelly-like mass called a *clot.*

The use of the clot is to stop bleeding. The clot closes the wound and keeps the blood from flowing out. If Nature did not protect us in this way, we might bleed to death from the smallest cut.

80. The Heart and the Blood-vessels.—The heart is a hollow muscle, about as large as one's fist. It is shaped like a pear or a strawberry, and it lies in the chest, a little to the left of the middle, with the small end down (Fig. 21).

There are two sets of blood-vessels connected with the heart, one set to carry blood *away* from the heart, and another set to bring the blood *back* to the heart. The blood-vessels that carry blood *away* from the heart are called *arteries*. Those that bring blood *back* to the heart are called *veins*. Between the arteries and the veins is a network of very tiny blood-vessels called *capillaries*.

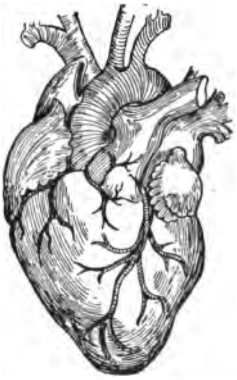
Fig. 21.—The heart.

The blood flows away from the heart through one large artery which divides into smaller and smaller branches. From the arteries the blood flows through the capillaries into small veins. The veins run together until they form two large veins which bring the blood back to the heart.

81. How the Heart Works.—The heart is a hollow muscle. It works very much like a rubber bulb. As the blood comes back through the veins, the heart *expands* or grows larger, until it is filled with blood. Then it *contracts*, or grows smaller, and forces all the blood out into the arteries. We call this expanding and contracting the *beating* of the heart. The heart beats about 72 times a minutes,—a little faster in children.

As the heart beats, it sends the blood out in spurts or waves. We can feel these waves in any artery that lies near the skin, as at the wrist and at the temple. The beating that we can feel in the arteries is called the *pulse*.

To keep the blood moving in the right direction, the heart is provided with little swinging doors or gates called *valves*. These will open only one way. As soon as the blood begins to flow backward they close. Where the blood flows *into* the heart there are valves that let the blood flow in but will not let it flow out when the heart contracts. Where the blood flows *out* of the heart there are other valves that let it flow out but will not let it flow back into the heart when the heart expands (Fig. 22).

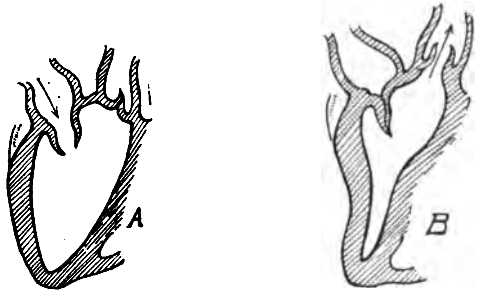

Fig. 22.—The valves of the heart: *A*, The heart *expands* and the blood *flows in; B*, the heart *contracts* and forces the blood *out*. Notice how the valves open and close.

82. How the Blood Gets Oxygen.—The heart is double; it has two sides. The left side of the heart pumps the blood out through the arteries that carry it to all parts of the body. When the blood flows through the capillaries, it loses its oxygen. When it comes back to the heart, it goes to the right side; and the right side of the heart sends it to the lungs. In the lungs the blood gets a fresh supply of oxygen and loses some of the waste matter that it has carried away from different parts of the body. From the lungs the blood is carried back to the left side of the heart again, to be sent through the body once more.

83. Circulation and Health.—Every part of the body depends upon the blood to bring nourishment to it and to carry its waste matter away from it. Without good blood it is impossible for us to be healthy and strong.

If your heart should stop beating, even for a few minutes, you would die at once. If the heart becomes weak, so that it can not keep the blood circulating properly, every part of the body suffers. A weak heart hurts the body in two ways: the body does not get enough nourishment, and it can not get rid of its waste matter. It is very important for us to know what makes good blood and how to take care of the heart.

84. What Makes Good Blood.—To have good blood we must eat good food, we must have plenty of pure water, we must get plenty of fresh air, and we must keep the body clean.

We must eat good food and drink pure water because blood is made from our food and drink. We must have fresh air because the blood gets its oxygen from the air we breathe. Without oxygen the blood could not keep us alive. The body gets rid of part of its waste matter through the skin. If the skin is not kept clean, this waste matter stays in the blood and helps to make it impure.

85. The Care of the Heart.—The heart is often injured by *poisons*, particularly by alcohol and tobacco. These two things cause many cases of heart disease. Alcohol makes the heart weak because it turns part of the muscle of the heart into fat. Tobacco makes the heart irregular. Heart disease often follows other diseases, especially scarlet fever, diphtheria, and rheumatism. When one has any of these diseases, he should be under the doctor's care until he is entirely well.

Another common cause of heart disease is *overwork*. You have all noticed how much harder and faster your heart beats when you run, even for a short distance. If this is kept up too long, it will surely injure the heart. Ordinary exercise is good for the heart. It makes it stronger and healthier, just as it does other muscles; but violent exercise, if it is kept up longer than a few minutes, is very bad for the heart. Jumping rope for a long time, running long races, and lifting heavy weights are all likely to injure the heart.

To keep the heart healthy and strong, we must take time for rest and sleep. The heart must keep on working day and night. It can not stop to rest, as other parts of the body do. The only chance it has to rest is between beats. When the whole body is at rest, the heart does not have to beat so hard or so fast as when we are at work. In this way it can get the extra rest it must have to keep strong and healthy. Men who have always led a busy life, and who have not taken enough time for rest and sleep, often suffer from heart disease. Many men of this kind die between the ages of fifty and sixty because their hearts are worn out. With proper care as to rest and sleep, they might have lived many years longer.

The heart may be injured by a heavy blow on the chest, by a sudden plunge into very cold water, by sudden fright, or by anything else that shocks the body. Each of these things has sometimes caused sudden death from heart failure.

Tight collars, tight sleeves, tight garters, and tight clothing about the waist press upon the blood-vessels and keep the blood from circulating freely. The veins are usually pressed upon more than the arteries because they lie nearer the skin. Tight collars give us a feeling of fulness in the head because the arteries are carrying blood to the head, but the veins can not easily carry it back to the heart. For the same reason tight sleeves and tight garters may cause swelling of the hands and the feet.

86. Effect of Alcohol and Tobacco on the Heart.—Alcohol acts on the heart like a whip on a horse. Physicians sometimes use it for that purpose. It makes the heart work harder and faster for a short time, but it does not give strength to the heart any more than the whip gives strength to the horse. After the effect of the alcohol has passed off, the heart is weaker than it was before. The continued use of alcohol is one of the most common causes of heart disease. It often turns part of the heart muscle into fat. The "fatty heart" is always a weak heart.

The arteries are made up largely of tiny muscle fibers. This makes them elastic. They expand and contract with every beat of the heart. Alcohol is a poison to these muscle fibers. It deadens them so that they can not contract. The arteries stretch and become much larger than they should be. This is what causes the red face and nose of the drunkard. These swollen arteries make it very hard for the heart to keep the blood circulating properly. After the blood-vessels have been stretched in this way for some time, they become hard and brittle. They break very easily, and a great deal of blood may be lost before the bleeding can be stopped.

The use of tobacco makes the heart irregular. It often skips or misses a beat. Physicians call this form of heart disease "tobacco-heart." Sometimes it is very serious. It always interferes with the circulation of the blood.

QUESTIONS

Describe the blood. Of what is it composed?

Explain the uses of the blood.

What is meant by coagulation? What is its use?

Describe the heart. Name the different kinds of blood-vessels. What is the use of each?

Explain how the heart works. What is the pulse? Why does the doctor feel your pulse when you are sick?

Explain the use of the valves of the heart.

Show how health depends on good blood and good circulation.

Tell what we must do to have good blood.

How does overwork injure the heart?

What is the effect of ordinary exercise on the heart? Of excessive exercise? What kinds of exercise are likely to injure the heart?

Why are rest and sleep necessary to keep the heart healthy?

Name some things that may cause sudden heart failure.

What is the effect of tight clothing on the circulation?

How does alcohol act on the heart? How may the continued use of alcohol injure the heart? How does alcohol act on the arteries?

How does tobacco injure the heart?

CHAPTER IX

DISEASE GERMS

87. Some Diseases are "Catching."—Early in 1885 there were several cases of smallpox in Chicago. A railroad conductor who had been near one of these people travelled from Chicago to Montreal, and there he himself was taken sick with smallpox. There were no other cases of smallpox in the city at that time, but there were thousands of people who had not been vaccinated. Some of these people caught smallpox from the railroad conductor. Other people caught it from them, for smallpox is one of the most "catching" diseases. In nine months over 3000 of the people of Montreal died of smallpox, all because one man caught the disease in Chicago and brought it to Montreal.

We can avoid catching smallpox by being vaccinated, but there are other diseases almost as catching as smallpox that can not be avoided so easily. If a boy comes to school with measles, other children are sure to get it. If you knew that another pupil had scarlet fever or diphtheria, you would not go near him, because you would be afraid of catching the same disease.

Diseases that one may catch by going near those who are sick or "coming in *contact*" with them are called *contagious diseases.* Some of the common contagious diseases are scarlet fever, diphtheria, measles, mumps, whooping-cough, and chicken-pox.

88. The Cause of Contagious Diseases.—Forty years ago nobody really knew why some diseases are "catching." People had known for hundreds of years that there were some diseases that one person could catch from another; but how this happened they did not know. Some thought it was the breath of the sick person that made others sick. But people can catch some diseases without going near any one who is sick. Many people have caught smallpox and scarlet fever from clothing that was used by another person who had the disease. Doctors were sure that something was carried from the sick person to others who caught the disease, but they did not know what this was or how it could make others sick.

We know now that all contagious diseases are caused by *germs.* Disease germs are living things that come from the bodies of sick people. When these germs get into the bodies of other people, they give those people the same disease. Nobody ever had scarlet fever without getting the germs from some one else who had scarlet fever. Every time some one catches a contagious disease, he gets the germs from some one else who has the same disease.

Disease germs are so small that they can be seen only with a very powerful microscope. Doctors believed for several hundred years that contagious diseases were caused by germs, but they could not prove it because they had no microscopes strong enough to see the germs.

89. How It Was Proved that Germs Cause Disease.—In France, about forty years ago, thousands of chickens died every day of a disease called chicken cholera. If one hen got this disease, all the other chickens on the farm caught it too,—and all of them died. It was a very serious matter to the poor farmers.

A great French scholar named Louis Pasteur began to study the disease. He noticed that there was *one kind* of germs that could be found in *every chicken* that died of cholera. Then he learned that if he put a few of these germs on gelatine or in broth they would *grow*. In a short time there were millions of germs in the broth. He tried feeding some of these germs to healthy chickens, and every chicken that got any of the germs became sick with cholera. When these chickens died, he could always find the same germs in their bodies. He did this again and again, until there could be no doubt that these germs were the real cause of the disease.

About the same time Robert Koch, a famous German physician, discovered the germ of tuberculosis or consumption. He learned how to grow it, for these germs will not all grow in the same way.

He found that these germs would cause tuberculosis in animals, and when one of these animals died he could always find the same germs in its body. Robert Koch's discovery was announced in 1882. The germs of many other diseases have been discovered since that time.

Nobody knows how much the world owes to these two men. Before their time millions of people died every year of contagious diseases. Nobody knew why these diseases came or how they might be avoided. Pasteur and Koch proved to the world that these diseases are all caused by germs which come from the bodies of those who are sick, and they showed how such diseases can be prevented. The work that they did has saved the lives of millions of people in the last forty years and is saving millions more every year.

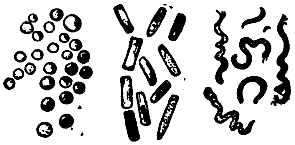
Fig. 23.—Three kinds of bacteria (highly magnified).

90. What Disease Germs Are.—There is a common notion that disease germs are tiny animals or bugs. This is not correct. There are a few diseases, like malaria, that are caused by very small animals that get into the body; but nearly all the common disease germs are little *plants*.

There are several kinds of plants which are so small that we can not see them without a microscope. The most important of them are called *bacteria*. Nearly all of the disease germs are bacteria (Fig. 23).

91. Bacteria and What They Do.—Bacteria are so small that it is almost impossible for us to form any idea of their size. There may be millions of them in a single drop of water. The smallest speck of dust may have hundreds of bacteria on it. A single drop of milk may have more than a billion bacteria in it.

Bacteria are found everywhere. Wherever men, animals, and plants live, there are always a great many bacteria. The soil swarms with them. Thousands of them float about in the air we breathe. They get into the water we drink and on the food we eat. Our own bodies are full of them. More than seventy kinds have been found growing on the skin and more than fifty kinds in the mouth. The intestines always contain enormous numbers of them.

More than a thousand kinds of bacteria have been discovered. Only a few of these cause disease. Most of them are harmless in the body. Many of them are very useful to us.

It is bacteria that make milk turn sour, and that turn cider into vinegar. The flavor of butter and of cheese is produced by bacteria. One of the most important things done by bacteria is to get rid of all kinds of dead animal and vegetable matter. When an apple rots, it is because bacteria have started to grow in it. Wood rots when it is wet because bacteria grow in it. It is bacteria that cause meat to spoil.

When plants and animals die, their bodies decay.

In a short time they become part of the soil on which they lie. This is what keeps the soil rich and fertile, so that plants can grow in it. All of this work is done by bacteria. If there were no bacteria, nothing would decay. In a short time the soil would be worn out; no more plants could grow in it. Then there would be no food for animals to eat and soon they would all die too. Neither plants nor animals could live long if there were no bacteria.

92. How Bacteria Grow.—Bacteria are small living plants. Like other plants they will grow only when they are kept warm and moist. Then they grow very fast, but they do not grow in quite the same way that most plants do. Perhaps you have seen your mother cut a "slip" from a geranium and plant it (Fig. 24). In a short time the slip takes

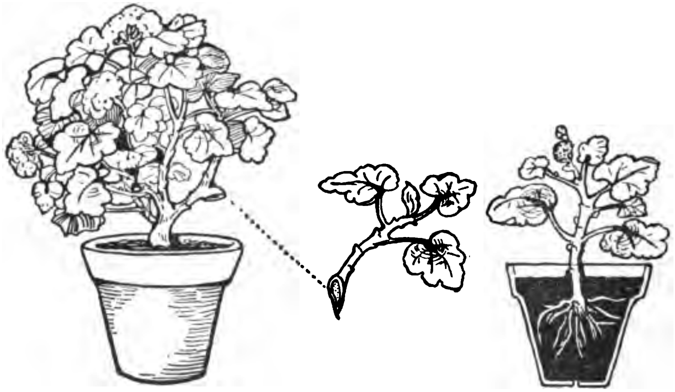

Fig. 24.—A slip cut from a geranium grows into a new plant.

root and grows. At first it was part of another plant. Now it is a new plant, and there are two plants instead of one. Rose bushes, grape vines, willow trees, and other plants can be grown in the same way.

The way bacteria grow is even more simple. When they are kept warm and moist and have plenty of food, they grow to a certain size, and then they divide into two parts (Fig. 25). Each of these parts is a separate germ. It grows and divides in the same way, until there are millions of germs where there was only one at first. Sometimes they divide every fifteen minutes. Starting with one germ, there will be sixteen at the end of an hour,—and many million at the end of twelve hours.

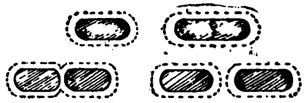

Fig. 25.—How bacteria grow.

Bacteria can not grow where it is very cold. That is why food does not spoil if it is kept on ice. Bacteria can not grow without moisture. Some foods are preserved by drying them. All bacteria are killed by boiling. Food is often preserved by boiling it and putting it in air-tight jars or cans. Salt keeps bacteria from growing. Beef, pork, and fish are often preserved with salt.

93. How Bacteria Cause Disease.—Most kinds of bacteria do not live long if they are taken into the body. The bacteria that live in the intestines are nearly all harmless. There are some kinds of bacteria that grow very fast if they get into the body and that make us sick. These are called disease germs.

There are two ways in which germs cause disease. Sometimes they destroy the part of the body in which they grow, just as other bacteria destroy an apple. When some kinds of bacteria get into the skin they destroy part of it and produce a boil or a running sore.

There are other germs that produce *poisons* when they grow in the body. These poisons get into the blood and are carried all over the body. It is these poisons that make us sick. Scarlet fever germs do not destroy the parts of the body in which they grow. We are not even sure in what part of the body they grow. But they produce very dangerous poisons which often kill little children. Some germs, like those of consumption and typhoid fever, cause disease both by destroying parts of the body and by producing poisons.

The poisons produced by disease germs are called *toxins*. Physicians have found things that will overcome some of these toxins. Such substances are called *antitoxins*.

QUESTIONS

What are contagious diseases? Name some contagious diseases.

Why are some diseases contagious?

Explain how it was proved that contagious diseases are caused by germs.

Tell why we should remember the names of Pasteur and Koch.

What are disease germs?

Give some facts about the size of bacteria.

Where are bacteria found?

Tell some of the things that bacteria do. What is their most important work?

Explain how bacteria grow.

What things check the growth of bacteria? In what ways do we make use of this?

Explain how bacteria cause disease.

CHAPTER X

HOW TO PREVENT CONTAGIOUS DISEASES

94. Contagious Diseases Can Be Prevented.—Every corn stalk you ever saw grew from a grain of corn, and that grain of corn came from some other corn stalk. Every person who ever had typhoid fever had the *germs* of typhoid fever planted somewhere in his body, and those germs came from some one else who had typhoid fever. This is true of every contagious disease. Nobody ever had any contagious disease until the germs of that disease got into his body; and the germs always came from some one else who had the same disease.

If we could keep germs from passing from those who are sick to those who are well, there would never be any contagious disease. This is often hard to do, but it is not impossible. Every contagious disease is an unnecessary disease. Contagious diseases can all be prevented. They will be prevented as soon as all of us care enough about it.

95. Three Things We Must Know.—To prevent contagious diseases, there are three things we must know: First, how germs escape from the bodies of the sick; second, how germs may be carried from place to place; and, third, how germs get into our own bodies.

96. How Germs Escape from the Body.—When a person has a contagious disease, the germs may be thrown off from his body through the nose and the mouth, from the skin, or by the bowels.

In ordinary breathing, the breath itself is not contagious. Germs are thrown off in coughing and in sneezing. When we cough or sneeze, tiny droplets of water are thrown from the nose and the mouth (Fig. 26). Germs may be carried for several yards by these droplets. Diphtheria, scarlet fever, measles, and whooping-cough are spread in this way. The germs of consumption are coughed up in the "spit" or sputum. In some contagious diseases the germs are found in the skin. They escape from the body with the dry scales that are always being shed from the outer layer of the skin. The germs of smallpox, chicken-pox, scarlet fever, and measles are thrown off from the skin.

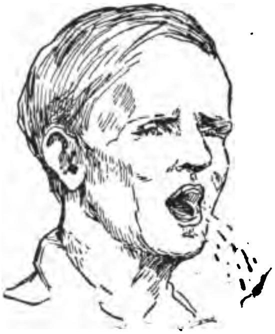

Fig. 26.—Germs are spread by coughing and sneezing.

The germs of typhoid fever, dysentery, and cholera grow in the intestines. They escape from the body with the contents of the bowels.

97. How Germs Travel.—One may get smallpox, typhoid fever, cholera, and other diseases without going near any one who has these diseases. Some germs live for weeks after they are thrown off from the bodies of the sick. They may be carried to places many miles away and there give the disease to some one else. There are four chief ways in which germs are carried,—by the air, by water, by clothing, and by insects.

98. Germs Carried by Air.—The germs that come from the bodies of sick people are often carried about by the *dust* in the air. The air in your room may seem perfectly clear and free of dust, but if the sun shines in through the window you will be surprised to see how many specks of dust are floating in the air. Each bit of dust may have hundreds of bacteria on it. The germs of consumption are often carried by dust. The sputum of the consumptive may have millions of germs in it. When the sputum dries, the germs are blown about in the air. They may get into our lungs with the air we breathe, into our water or milk, or on our food. The germs of smallpox, scarlet fever, pneumonia, and measles may be carried by the dust in the air. The germs that cause pus or "matter" in wounds and those that cause blood-poisoning are often carried by dust.

Dust is a dangerous thing. The best way to avoid dust in our homes is to use a vacuum cleaner, but a great deal can be done without it. Furniture should be plain, so that dust may be easily wiped off. Floors should be covered with rugs rather than carpets, and the rugs should be cleaned outdoors. Windows should be opened wide when the floor is swept. Dusting should be done with a damp cloth which will hold the dust instead of scattering it about the room as is done with feather dusters and dust brushes.

On country roads, dust may be kept down by sprinkling them with oil once or twice during the summer or by sprinkling them several times a day with water. Paved streets should be swept every day to keep them clean. They should always be sprinkled just before sweeping, to keep down the dust.

Germs are often scattered by spitting on the street, in railroad stations, in cars, and in other public places. This filthy practice should be forbidden by law. The man who spreads disease germs by spitting on the sidewalk is more dangerous than the robber who carries a loaded pistol.

99. Germs Carried by Clothing.—When a child has scarlet fever, the germs get on his clothing, on the bedding, carpets, towels, curtains, dishes, and other things used in the room. They get on the clothing of those who are taking care of him. If any of these things are carried where other people are, they may give the disease to those people. The germs of many diseases die in a short time, but there are some that remain alive for months. People have caught smallpox and scarlet fever from old clothing months after it was used by persons who had these diseases. The germs of measles, diphtheria, consumption, and erysipelas may all be carried by clothing.

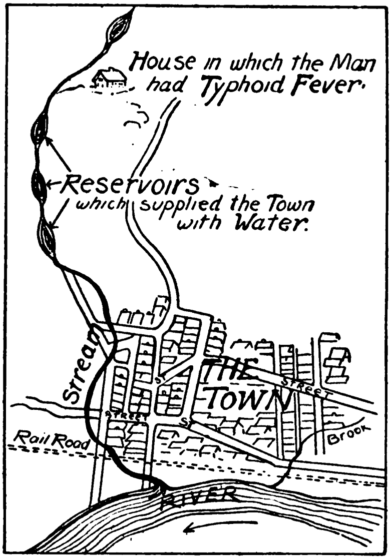
House in which the Man had Typhoid Fever
Reservoirs which supplied the Town with Water
Stream
THE TOWN
Street
Street
St
Brook
Rail Road
RIVER

Fig. 27.—Map of Plymouth, Pennsylvania. Showing how the waste matter from one sick-room caused over one thousand cases of typhoid fever and more than one hundred deaths.

100. Germs Carried by Water and Milk.—Early in 1885 there was a case of typhoid fever in the mountains above Plymouth, Pennsylvania. The man who was sick had spent the Christmas holidays in Philadelphia, and came home sick in January. All the waste matter from his body was thrown out on the ice and snow. About forty feet from his house there was a brook. This brook ran into a dam from which the town of Plymouth got its drinking water (Fig. 27). In April there were heavy rains, and all the waste matter that had been thrown out on the snow was washed into the brook, and from there into the dam. Just two weeks later typhoid fever broke out in the town. In a short time 1104 people were taken sick, and 114 of them died. All of these people got the germs of typhoid fever from their drinking water, and all of these germs came from the one man who brought the disease from Philadelphia.

In many other epidemics of typhoid fever, it has been proved that the germs were carried by water. Many cities that get their drinking water from rivers have built *filter plants.* All the water runs through beds of sand four or five feet deep before it goes into the water pipes, and the sand strains all the germs out of it. Even if the water is not filtered, we can easily avoid getting typhoid fever from it by *boiling all the drinking water.* All typhoid germs are killed by boiling the water for a few minutes. *Boiled water is always safe.*

The germs of typhoid fever are often carried in *milk.* The germs may get into the milk from the hands or the clothing of some one who is just getting over typhoid fever or who is nursing some one who has it. Sometimes the germs are in the water that is used in washing the pails and bottles, and some of the germs are left in the bottles. Typhoid germs grow very rapidly in milk if it is not kept on ice. A single germ will grow to a million or more before the milk is used. The germs of scarlet fever and diphtheria are sometimes carried in milk also. Milk can be made safe by *pasteurizing* it. (See Section 45.)

101. Germs Carried by Insects.—The common house fly seems perfectly harmless, but it is one of the most dangerous insects we have. A single fly may carry over 10,000 germs on its feet (Fig. 28). Flies go everywhere and they may carry almost any kind of germs. They get smallpox germs and scarlet fever germs from the skin of people who have these diseases. They feed on the sputum of consumptives and on the discharges from the bowels of typhoid fever patients. They get thousands of germs on their feet and scatter them wherever they go,—in our milk, on our food, even on our own hands and faces, for they never "wipe their feet." No one is safe from disease where there are flies.

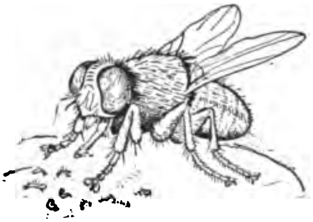
Fig. 28.—The house fly. A great carrier of disease germs.

The best way to get rid of flies is to destroy their breeding places. They lay their eggs in manure, in garbage, and in decaying vegetable matter. Wherever there is filth, flies are sure to breed in warm weather. With a little trouble all this can be prevented. Manure should be kept in covered boxes or pits, or it should be hauled out to the fields, away from the house. Stables, barns, and barn-yards should be kept clean. Garbage pails should be tightly covered. If we can not get rid of the places where flies breed, we should sprinkle such places several times a week with carbolic acid or chloride of lime. This will kill the young flies as fast as the eggs hatch. Where there are flies, doors and windows should be screened to keep them out of the house. It is very important to keep food of all kinds away from flies and dust.

The germs of yellow fever and malaria are always carried by *mosquitoes*. In these two diseases, the germs are in the blood of the sick person. The mosquito takes the germs into its own body when it bites any one who is sick with the disease, and it gives the disease to other persons whom it bites later.

Mosquitoes breed in stagnant water,—rain barrels, cisterns, and swamps. Dozens of them may hatch out in the rain water that collects in an old tin can. Cisterns and rain barrels must be covered or screened. Swamps and stagnant pools should be drained. If this can not be done, a little coal oil poured on the water will keep mosquitoes from breeding in it. Most mosquitoes do not fly far from the place where they are hatched. If all the breeding places near a house are destroyed, there will be no mosquitoes there.

Persons who have malaria or yellow fever must always be carefully screened from mosquitoes so that the germs will not be carried to other persons.

In India, thousands of people die every year of a terrible disease called the plague. The germs of this disease are carried by *fleas*, which live on rats and other small animals. These animals get the disease themselves, and the germs are carried from them to human beings by fleas.

Disease germs are sometimes carried by *animals*. Cats sometimes have diphtheria, and they may give the disease to children. The germs of other diseases may be carried by dogs and other pets.

102. How Germs Get Into Our Bodies.—Germs get into our bodies in three ways,—with the air we breathe, with our food and drink, and through the skin.

Disease germs that are carried about in the air may get into the nose, the throat, and the lungs. Most colds and sore throats are caused in this way. Tuberculosis may attack almost any part of the body, but it is most common in the lungs because the germs get into the body with the air we breathe.

Typhoid fever is nearly always caused by impure water or milk. The germs of many other diseases may be taken into the body with unclean food.

There are always a great many bacteria on the skin. Most of them are harmless, but some of them may be dangerous disease germs. The smallest cut will allow them to enter the body. Blood-poisoning and lockjaw are caused in this way.

All wounds, no matter how small, should be washed out thoroughly with something that will kill germs. Such liquids are called *antiseptics*. Peroxide of hydrogen is best for general use. Bichloride of mercury, dissolved in water, and carbolic acid—a teaspoonful in a half pint of water—are excellent antiseptics; but one must be careful in using these as they are poisonous. Iodine and alcohol are good antiseptics.

103. Quarantine.—When a person has a contagious disease, like scarlet fever,. diphtheria, or smallpox, nobody should be allowed to go near him except the doctor and the nurse. The other members of the family should not be allowed to go to school or to any place where some one else might get the disease from them. A card should be placed on the door to warn people to keep away from the house. When these things are done, we say the house is *quarantined.* In most places this is done by the Board of Health.

104. Disinfection.—Anything that has disease germs on it or in it is said to be *infected.* When a child has scarlet fever, everything in his room is infected with germs. There are several ways in which these germs may be *killed.* When this is done, the room is *disinfected.* Dishes, knives, forks, and spoons may be disinfected by boiling them. The best way to disinfect a room is to sprinkle it with formaldehyde, which can be bought at any drug store. When this is sprinkled on the floor, it gives off a gas which soon kills all disease germs. The doors and windows must be closed tightly and kept closed for at least six hours. Clothing may be disinfected with formaldehyde or by boiling it. In typhoid fever the germs are found in the waste matter from the bowels, and this must be thoroughly disinfected with carbolic acid or with lime.

105. How to Keep Germs Out of Our Bodies.— No matter how careful people may be, there are some cases of sickness from which germs are carried where other people are, and we should know how to avoid taking them into our bodies.

The body must be kept clean. The hands and face should always be washed before eating. If we are not sure that the water and the milk are pure, the water should be boiled and the milk pasteurized. We should never eat or drink anything that has been exposed to flies, or to the dust of the street. Milk and food must be handled only with clean hands and must be kept and sold only in clean places.

No matter what care we may take, some germs are sure to get into the body now and then, especially if we live in town or go to school. They do not always make us sick. The body has ways of fighting germs. If there are not too many germs, it can overcome them; but to do this it must be kept well and strong. To help the body to fight disease germs we must have plenty of good food, plenty of fresh air and sunlight, plenty of outdoor exercise, and we must keep the body clean.

QUESTIONS

How are all contagious diseases caused? How can we prevent them?

What things must we know if we would prevent contagious disease?

Explain all of the ways in which germs escape from the bodies of sick people.

Name some diseases whose germs are thrown off through the nose and the mouth. From the skin. Through the bowels.

In what ways are germs carried?

Explain how germs are carried about in the air. What germs are carried in this way? Why is spitting on the street and in cars forbidden?

What germs may be carried by clothing?

Tell the story of typhoid fever at Plymouth.

What germs may be carried by water and milk?

How may cities and towns make their water safe?

How can unfiltered water be made safe?

How do germs get into milk? How can milk be made safe?

Explain why flies are dangerous. What should be done to get rid of flies?

What other insects carry disease germs? How can we get rid of them?

What animals may carry germs?

Name three ways in which germs get into the body.

What germs may be taken into our bodies with the air we breathe?

What germs may be found in our food and drink?

Explain how germs get into the body through the skin. What diseases are caused in this way?

Tell how all wounds should be treated, and why.

What is done when a house is quarantined? Why is this done?

What does "infected" mean? "Disinfected"? Explain the best ways of disinfecting dishes, clothing, and rooms.

Tell what we can do to keep germs out of the body.

How can we help the body to fight disease germs?

CHAPTER XI

TUBERCULOSIS AND OTHER CONTAGIOUS DISEASES

106. "The Captain of the Men of Death."—Tuberculosis is one of the most common and one of the most dreadful diseases. More people die of it than of any other disease. In the United States about 150,000 persons are killed by tuberculosis every year, more than 400 every day. Every three minutes some one dies in this country of tuberculosis. No wonder it has been called "The Captain of the Men of Death."

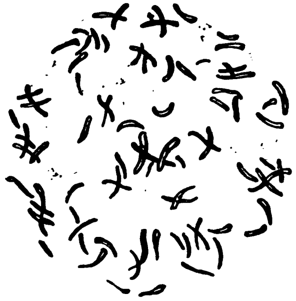

Fig. 29.—Germs of tuberculosis. (Highly magnified.)

Tuberculosis attacks animals as well as men. It is very common among cattle. It often attacks goats and hogs, and sometimes sheep, horses, dogs, and cats. Monkeys kept in cages nearly all die of tuberculosis. Wild animals do not get it, but when they are caught and kept in cages they often die of it.

107. Cause of Tuberculosis.—Tuberculosis is caused by a germ called the *tubercle bacillus* (Fig. 29).

These germs always come from some other person or some animal that has the disease. They get into the lungs with the air we breathe or into the stomach and intestines with milk and other food. In most cases the disease starts in the lungs. Sometimes it starts in the intestines, and the germs are carried to the lungs by the blood. In the lungs the germs find just what they need to grow. It is warm and moist, and the delicate lung tissue is just the kind of food they need. So they grow and grow until there are many millions of them. As they grow, they destroy the lung tissue and leave large holes or cavities in it. Sometimes almost the whole lung is eaten away.

108. Tuberculosis is Not Inherited.—When grown people have consumption, their children very often get it too. People used to think that the children inherited the disease, that they were born with the disease. We know now that this is not true. Children are not born with tuberculosis, but if their parents have the disease the children are sure to get the germs unless the parents are very, very careful. The children of tuberculous parents often have weak bodies. They can not fight disease germs as strong healthy children do, and when the tubercle bacillus gets into the lungs it is almost sure to give them consumption.

109. Tuberculosis From Infected Rooms.—When a person has consumption, he often coughs up several billions of the germs every day. In the open air these germs soon die. Sunlight kills them quickly. But in dark, damp rooms they remain alive for a long time, perhaps as long as a year. The carpets, the floor, and the walls are full of them. They float about in the air of the room, and any one else who uses the room is sure to take some of the germs into his body. In the tenement houses in our large cities there are rooms where one person after another gets consumption and dies. In many places there are houses with the same history. People who have consumption live in the house. Perhaps they die there, or they may move away. Another family moves in, all in good health. In a few months or a year some of them have consumption, and in a few years they are dead. Another family moves in and the same thing happens to them. There is no doubt that these people get consumption from infected rooms. The germs are in the house, and everybody that lives in it is sure to get them. One should never move into a house without having it thoroughly disinfected. The Board of Health will usually do this if you request it.

110. Consumption.—Tuberculosis may attack almost any part of the body, but it is most common in the lungs. Tuberculosis of the lungs is called consumption.

Consumption is a very dangerous disease. The most dangerous thing about it is the way it begins. At first it is such a mild, slow disease that many people do not know they have it until they are too sick to be cured. When the tubercle bacillus gets into the lungs, it may grow there for months before there are any signs of the disease. Perhaps the person feels a little more tired in the evening than usual. His appetite is not quite so good, and he may lose a little in weight. He may have a little pain in the chest now and then, and a slight cough. He may be a little feverish every afternoon or evening. For a long time he may notice nothing else. All of these things are so slight and seem so trifling that he never suspects that anything is wrong. He has consumption, but he does not know it. He could still be cured, but in a short time it will be too late.

As the disease goes on, his appetite gets poorer and poorer. He can not digest what he eats, and he loses weight rapidly. His cough gets worse. He begins to spit up blood and pus. He has fever and night sweats. All of these things steadily grow worse, he gets weaker and weaker, and finally dies.

111. Other Forms of Tuberculosis.—In children, the tubercle bacillus often attacks the bones and joints. Sometimes part of the spinal column is destroyed, causing hump-back. The joints that are most often affected are the hip, the knee, the ankle, and the shoulder. Hip-joint disease and "white swelling" or knee-joint disease are forms of tuberculosis. Children often suffer from "swollen glands" of the neck, and this is often, though not always, a form of tuberculosis. The intestines, the liver, the heart, and the brain may all suffer from tuberculosis. When the germs grow on the coverings of the brain they cause meningitis.

112. How to Prevent Tuberculosis.—Children sometimes get tuberculosis from infected milk and other food. In large cities the milk is usually inspected by the Board of Health. The cows should be tested every year to make sure that they do not have tuberculosis. If one is not sure that the milk is safe, it should be pasteurized.

Nearly all cases of tuberculosis are caused by germs that are coughed up by those who have consumption. *The sputum of consumptives is the great source of danger.* If this were always thoroughly destroyed, there would be very few new cases. Consumptives should use spit-cups of paper or metal. It is not safe to use handkerchiefs or cloths. The sputum gets on the clothing and on the hands, and germs will surely be carried to other persons. Paper spit-cups should be burned after they have been used. Metal cups should be disinfected with carbolic acid and washed in boiling water. Spitting on sidewalks, in street cars, and in other public places should be forbidden by law.

It is not safe to stay in a closed room with a consumptive for a number of hours every day. Children with tuberculosis of the lungs should not attend school unless they can be placed in an "open-air" class.

The consumptive should have his own room, which must be well ventilated. He should hold a cloth before his face when he coughs, and this cloth should be burned. His clothing should be handled as little as possible by others, and should be boiled when it is washed. Rooms that have been occupied by a consumptive should be thoroughly cleaned and disinfected before they are used by any one else. When a person has consumption, the danger of spreading the disease should be kept in mind all the time; and everything possible should be done to prevent it.

113. How Consumption is Cured.—Two things only are necessary to cure any case of consumption that can still be cured,—*fresh air* and *plenty of good food*. Patent medicines that are advertised as cures for consumption are *all frauds*. There is no medicine that will cure the disease, and most of them make it worse.

Plenty of fresh air, day and night, and nourishing food that is easily digested, like milk and raw eggs, will cure most cases if the disease has not gone too far. Consumption can be cured if the treatment is begun early and if the doctor's orders are carried out fully. If a cough lasts more than three weeks, especially if the person has fever and pain in the chest, he should see a doctor without delay. These are danger signals and they must be heeded promptly. To wait even a month may make the case hopeless.

114. Prevention is Better Than Cure.—Those of us who live in cities can hardly help getting the tubercle bacillus into our lungs. If we take good care of our bodies, and do not get too many of the germs, the body can overcome the germs and kill them. It is only those who are "run down" or who stay in the room all day with a consumptive that are likely to get consumption.

Breathe pure, fresh air, day and night. Stay out in the sunshine as much as you can. Take plenty of exercise in the open air. Eat nourishing food. Keep the body clean. These are the things that will keep you from getting consumption. Remember that consumption is a house disease, a disease caused by infected rooms and by rooms that do not get fresh air and sunlight. People who work outdoors and who keep their windows open at night hardly ever get it. Wild animals never suffer from it; when caged, they nearly all die of it. It is indoor life, without fresh air and sunshine, that gives the tubercle bacillus its chance to grow and to give us consumption.

115. Diphtheria.—Diphtheria may attack grown people, but it is most common in children. It is sometimes called "membranous croup." It usually begins with sore throat, chills, and fever. Sometimes the disease is so mild that it seems to be just an ordinary cold or a simple sore throat, and no one thinks of diphtheria. These children give the disease to others. Children should never exchange whistles, candy, chewing gum, drinking cups, or anything else that is put into the mouth.

Diphtheria germs produce a poison or toxin. About twenty years ago a German physician discovered a cure for diphtheria, which is called antitoxin. Before this was used, more than half of all the children who had diphtheria died. Now hardly any die if they get antitoxin on the first or second day of the disease.

Diphtheria is a very contagious disease. Strict quarantine is necessary until the throat of the patient is entirely clear of germs.

116. Scarlet Fever.—Scarlet fever is a disease of childhood. Grown persons hardly ever get it. It begins with sore throat, vomiting, high fever, and a very rapid pulse. On the second day a bright scarlet rash comes out on the neck and chest, and spreads over the whole body. After the rash disappears, the outer layer of the skin peels off in tiny scales or in large flakes.

The disease is very contagious. Strict quarantine is necessary until the peeling of the skin has stopped entirely. This may take six or eight weeks. Everything used by the patient must be thoroughly disinfected.

117. Measles.—Measles begins as a bad cold. The rash comes out on the fourth day. The skin peels in small flakes as the rash fades out. The disease is very contagious. Children should be quarantined for at least three weeks, and their clothing and the room should be disinfected.

Measles, whooping-cough, mumps, and chicken-pox are often called "children's diseases." Grown persons hardly ever take them. Ignorant parents sometimes take their children to houses where other children have one of these diseases, so that their own children will get it. They think the children will get it anyhow; and the sooner they have it, the better. This is a wicked thing to do. A great many children die of measles and of whooping-cough every year. Both diseases are often followed by pneumonia, and this kills many children. It is not necessary for any one to have any of these "children's diseases."

Children who have whooping-cough need plenty of fresh air. It is often best to keep them outdoors, but they must be kept away from other children until the cough stops. This may be several months.

Mumps and chicken-pox are much less serious than measles and whooping-cough. Children who have these diseases should be kept away from other children, and the room should be disinfected.

118. Vaccination and Smallpox.—Two hundred years ago smallpox was one of the most common diseases. In many places almost everybody got it sooner or later. It killed millions of people, and those who were not killed were marked for life with its scars.

A little over a hundred years ago, Dr. Jenner, an English physician, noticed that milkmaids who had had cowpox, a disease of cattle, did not take smallpox. People had known for a long time that those who had once had smallpox did not take it again. It occurred to Dr. Jenner that by giving a child cowpox he might prevent its taking smallpox. By giving children the cow's disease (which he called vaccination from the Latin word vacca which means cow) he hoped to protect them from smallpox, just as if they had had smallpox.

He tried this, and proved that it did protect people from smallpox. In nearly all civilized countries, vaccination is now compulsory. In these countries there is hardly any smallpox. In countries where vaccination is not required by law, smallpox is still common.

People can now be vaccinated for typhoid fever as well as for smallpox. The soldiers of the United States army are all vaccinated for typhoid fever.

QUESTIONS

Tell why tuberculosis is sometimes called "The Captain of the Men of Death."

What animals does tuberculosis attack?

Tell how tuberculosis is caused.

How do the germs act on the lungs?

Why do the children of tuberculous parents so often get the disease?

Explain how one may get tuberculosis from an infected room or house. How may this be avoided?

What are the first signs of consumption? Why is it such a dangerous disease?

What parts of the body are affected besides the lungs?

Tell fully how consumption may be prevented. How can we avoid infection from milk? Where do the germs usually come from? How should the sputum of consumptives be treated? What care should be taken with the consumptive's room and clothing?

How can consumption be cured? Why should we avoid patent medicines?

Tell what each of us can do to avoid getting consumption.

What are the first signs of diphtheria? Why does the disease often spread among school children? In what ways may children give each other the disease? What is the best treatment for diphtheria?

What are the first signs of scarlet fever? How long should children be quarantined for scarlet fever? Why?

How does measles begin? How long should children be quarantined?

Name the "children's diseases." Which are most serious? Should children ever be exposed to them purposely?

Tell something about smallpox two hundred years ago. Why is it so rare now? Tell how vaccination was discovered.

CHAPTER XII

EMERGENCIES

119. Importance of First Aid.—The first thing to do in every serious accident is to send at once for a physician. Sometimes it is impossible to get a doctor at once. It may take several hours. If some one has taken poison, if he is choking, or if he is bleeding rapidly from a cut, he will die before the doctor comes unless there is some one with him who knows just what to do. Every one should know what is the best thing to do before the doctor comes.

Children often meet with slight injuries, for which no one thinks of sending for the doctor. These may become serious if they are not properly cared for. The right kind of care at the beginning may save a great deal of trouble later.

120. Wounds.—Wash out the wound thoroughly, using warm water that has been boiled. After all the dirt has been removed, wash out the wound with some antiseptic solution to prevent blood-poisoning. (See Section 102.) Peroxide of hydrogen is a good thing to use for this purpose.

Cover the wound with a *clean* bandage and keep it covered until it is entirely well. Put on a clean bandage every day. Every family should have on hand a small supply of bandages, carefully wrapped as they come from the drug store. They are not expensive and they may save one from blood-poisoning. *Never use old rags on wounds.*

If the wound is deep, and you are not *sure* that *all* the dirt has been removed, send for the doctor. Deep wounds that are not washed out thoroughly may cause lockjaw or blood-poisoning.

121. Bandages.—*Never* put an old, dirty bandage on a wound. Use nothing but fresh, clean bandages. Put some clean gauze or absorbent cotton on the wound before starting the bandage. Do not make the bandage too tight. If the fingers or the toes on the bandaged limb become cold and numb, loosen the bandage.

Bandages on the forearm and the hand will hold best if they are started at the wrist. Bandages on the leg or the foot should be started at the ankle. Slight wounds on the face, neck, or trunk may be covered with a pad of clean gauze held in place with strips of adhesive plaster.

Never cover up a wound with court plaster. If there are any germs or poisons in the wound, court plaster keeps them from being washed out and makes the sore worse.

122. Burns.—Burns that are large or deep are always serious. Send for the doctor at once.

One of the best remedies for ordinary burns is made by shaking together in a bottle equal parts of linseed oil and lime-water. Cover the burn with cotton or gauze wet with this mixture and put a loose bandage over it. Vaseline, olive oil, cold cream, or clean lard may be used to protect a burn from the air.

123. Clothing on Fire.—Do not play with fire. The smallest spark may be enough to set your clothing on fire and burn you to death.

If your own clothing is on fire, *do not run.* This only fans the flames and makes them burn faster. Throw yourself on the floor or on the ground, and wrap something around you to smother the flames. A rug, a blanket, or an overcoat will do,—anything that will shut off the air from the flames. If there is nothing at hand, roll over and over and try to put out the flames in this way.

If another person's clothing is on fire, you must act quickly. Throw water over him if it is at hand, but do not leave him to get it. Quickly wrap something about him to shut off the air from the fire. Take the first thing you can get. If there is nothing you can reach to wrap about him, throw him down and roll him over and over quickly. This will usually put out the fire and keep the flames from his face so that he will not breathe them in.

124. Nose-bleed.—Hold the head erect. Wet a cloth in cold water and hold it on the back of the neck, or hold ice to the nose and the back of the neck. If the bleeding does not stop in a short time, it is best to send for the doctor.

125. Fainting.—People faint because the brain does not get enough blood. Lay the person flat on a couch or on the floor. Keep the head low so that the blood will flow easily to the brain. Give him plenty of air. Loosen the clothing about the neck. Rub the hands and moisten the face with cold water. Never throw water on the face or try to force water or medicine down the throat of a person who is unconscious. He may be choked to death. If he does not recover in a few minutes, send for a doctor.

126. Choking.—A large piece of food, a bone, or a button may stick in the throat and keep air from getting into the lungs. This will cause death in a few minutes, so one must act quickly. Sometimes the object can be reached with the finger. A sharp blow on the back between the shoulders causes a sudden rush of air from the lungs, and this may be strong enough to force the object out. If a small child is choking, it should be held by the heels, head down, while several blows are struck on the back. If these things fail, try to make the person vomit by putting your finger down his throat.

127. How to Stop Bleeding.—If there is much bleeding from a wound, send for a doctor at once. If a large vessel is cut, the person may bleed to death in a few minutes, so something must be done at once.

Put a pad of gauze or cloth on the wound and bandage it as tightly as you can. If the cut is on the arm or the leg, tie a handkerchief about the limb, above the cut, put a stick through the handkerchief, and twist it tight enough to stop the flow of blood in the arteries (Fig. 30).

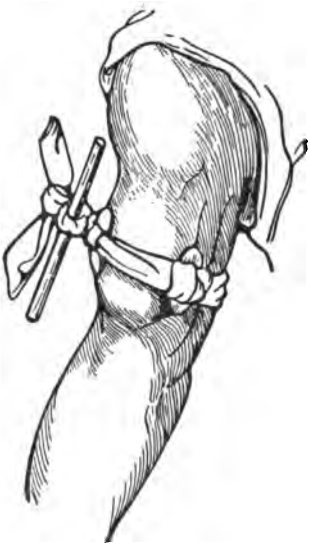

Fig. 30.—How to stop bleeding.

128. Blows on the Head.—Lay the person flat on his back. Put ice or cold cloths to the head. If he does not become conscious in a few minutes, send for a doctor. Blows on the head may not produce any bad effects at once. The person may become unconscious several hours later. He should be taken home as soon as possible and watched carefully for a number of hours.

129. Dog-bites.—If one has been bitten by a dog or by any other animal, it is best to see a doctor at once. If you can not do this, open the wound thoroughly and apply pure carbolic acid.

It is important to know if the dog is "mad." To make sure of this, the dog should be taken to the health officers or to the nearest hospital for a careful examination. If the dog has been killed, send the body. If it seems likely that the dog was "mad," the Pasteur Treatment should be given. It must be given promptly.

130. Poisoning.—Most cases of poisoning are caused by carelessness. Bottles and packages containing poison should be labeled plainly and locked up where children can not get at them. Do not keep poisons with medicines, and *never* take any medicine from a bottle without reading the label to make sure you have the right thing. It is a good plan to run a few pins through the corks of all bottles that have poisons in them, so that no one will take them for medicine bottles, even in the dark.

If a person has taken poison, send for a doctor at once. Then give the person something to *make him vomit.* Give a tablespoonful of mustard in a glass of warm water, warm water and salt, warm soapsuds, or warm water alone. Use the thing you can get first. If nothing is at hand, tickle his throat with the finger or with a feather. Make him vomit several times if you can. The more warm water he can drink and vomit the better his stomach will be washed out.

The next thing to do is to give something that will work against the poison, so that it will do no harm. This is called the *antidote.* Most poison labels have the antidote printed on them. *Remember that it is always safe to give plenty of the white of eggs.*

It is wise, especially where there are children, to keep a list of common poisons, with the remedy for each, in some place where one can be sure to find it quickly. Such a list is given below:

Arsenic (Rough on Rats, Paris Green, colored papers).

Make the person vomit.

Send to the nearest drug store for *special antidote for arsenic.*

Give *magnesia.*

Carbolic Acid (Phenol).

Give large quantities of Epsom salts.

Alcohol is a good antidote. Give *dilute alcohol* or *whisky.*

Bichloride of Mercury (Corrosive Sublimate, Antiseptic Tablets).

Make the person vomit.

Give large amounts of *white of egg.*

Iodine.

Make the person vomit.

Give large amounts of *starch.*

Lead (Sugar of Lead, Lead-water, Goulard's Extract).

Make the person vomit.

Give *Epsom salts.*

Opium (Morphine, Laudanum, Paregoric, Codeine, Heroin, Soothing Syrups, and Cough Mixtures).

Make the person vomit.

Give *hot black coffee* as the antidote.

Do not let the person go to sleep.

131. Frost-bite.—If ears, fingers, or toes are frost-bitten, they must be thawed out slowly and kept away from the heat until this has been done. Rub the frozen part with snow or cold water until feeling returns to it and the blood begins to flow in it. Then wrap it up in cotton.

132. Drowning.—A person under water soon dies because he gets no air. The heart keeps on beating for some minutes after breathing stops. If he is taken from the water during this time his life can be saved if we can make him breathe again. People have been saved after being under water fifteen minutes. Every one who goes swimming or rowing should know just what to do to save the life of a person who has been under water until he has become uncon-

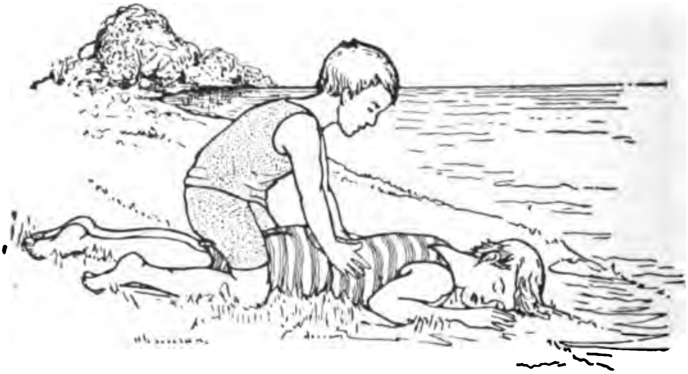

Fig. 31.—How to help a person who has been under water and has stopped breathing.

scious and has stopped breathing. If you expect to go swimming or rowing, practice this with one of your friends so that you will know just what to do in case of accidents.

Turn the person over on his chest, with his face turned to one side so that the nose and the mouth are off the ground (Fig. 31). Stand or kneel astride his body, facing the head. Place your hands, one on each side, over the small of the back. Now bend forward slowly, throwing your weight on his chest, and so forcing the air out of his lungs. Then swing backward, taking your weight off his back. As you do this, his chest comes up and his lungs are filled with air. Repeat these movements twelve or fifteen times a minute. If you count three as you swing forward and three as you swing backward, it will help you to get the time right.

Do not lose any time. Begin at once. If you wait a minute, it may be too late. Do not give up too soon. It is usually necessary to keep this up for a half hour before he can breathe naturally. The lives of some people have been saved after it was kept up for two hours.

QUESTIONS

Why should all of us know what to do for an injured person?

Tell fully how to care for a wound. What care must be taken with bandages? Why?

Tell how to put a bandage on the arm. The leg. Why is court plaster dangerous?

What remedies may be used for burns?

What should you do if your clothing catches fire? What should you do if another person's clothing is on fire?

Tell how to stop nose-bleed.

What should be done for a person who has fainted?

Tell how to help a person who is choking.

How would you try to stop bleeding from a wound?

What should be done for a person who has been struck on the head?

Tell what to do for dog-bites. What should be done with the dog? Why?

Tell how to *prevent* poisoning. What is the *first* thing to do if a person has taken poison? What must be done next? How would you try to make a person vomit?

What is an antidote? What antidote may always be given?

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